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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

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VOLUME 19 NUMBER 3/FEBRUARY 8, 1981

TABLE OF CONTENTS

AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

01 AERONAUTICS (GENERAL) 293

02 AERODYNAMICS 293

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 297

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 299

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command and Tracking* and *32 Communications*.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 300

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION N.A.

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 303

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 307

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 309

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 309

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

13 ASTRODYNAMICS 310

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) 311

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 311

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 314

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 314

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 314
For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 315
Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.
For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 316
Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 316
Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 318
Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.
For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 322
Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 324
Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 328
Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.
For related information see also *Physics*.

31 ENGINEERING (GENERAL) 332
Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 333
Includes land and global communications; communications theory; and optical communications.
For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

33 ELECTRONICS AND ELECTRICAL ENGINEERING 337
Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.
For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

34 FLUID MECHANICS AND HEAT TRANSFER 341
Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.
For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 346
Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.
For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 349
Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 351
Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 353
Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 354
Includes structural element design and weight analysis; fatigue; and thermal stress.
For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.
For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) N.A.

43 EARTH RESOURCES 359
Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

44 ENERGY PRODUCTION AND CONVERSION 368
Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.
For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation*.

45 ENVIRONMENT POLLUTION 381
Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

46 GEOPHYSICS 385
Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.
For space radiation see *93 Space Radiation*.

47 METEOROLOGY AND CLIMATOLOGY 388
Includes weather forecasting and modification.

48 OCEANOGRAPHY 391
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 391
Includes genetics.

52 AEROSPACE MEDICINE 392
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 394
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 394
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) 395

60 COMPUTER OPERATIONS AND HARDWARE 395
Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

61 COMPUTER PROGRAMMING AND SOFTWARE 397
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS 399
Includes computer networks.

63 CYBERNETICS 399
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 400
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 402
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 403
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 403
Includes topology and number theory.

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 404
For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar Physics*.

71 ACOUSTICS 405
Includes sound generation, transmission, and attenuation.
For noise pollution see *45 Environment Pollution.*

72 ATOMIC AND MOLECULAR PHYSICS 405
Includes atomic structure and molecular spectra.

73 NUCLEAR AND HIGH-ENERGY PHYSICS 408
Includes elementary and nuclear particles; and reactor theory.
For space radiation see *93 Space Radiation.*

74 OPTICS 410
Includes light phenomena.

75 PLASMA PHYSICS 410
Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics.* For space plasmas see *90 Astrophysics.*

76 SOLID-STATE PHYSICS 415
Includes superconductivity.
For related information see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

77 THERMODYNAMICS AND STATISTICAL PHYSICS 418
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 419
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 419
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS 420
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 420
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 421
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) 423

89 ASTRONOMY 423
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 423
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 424
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 425
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 425
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

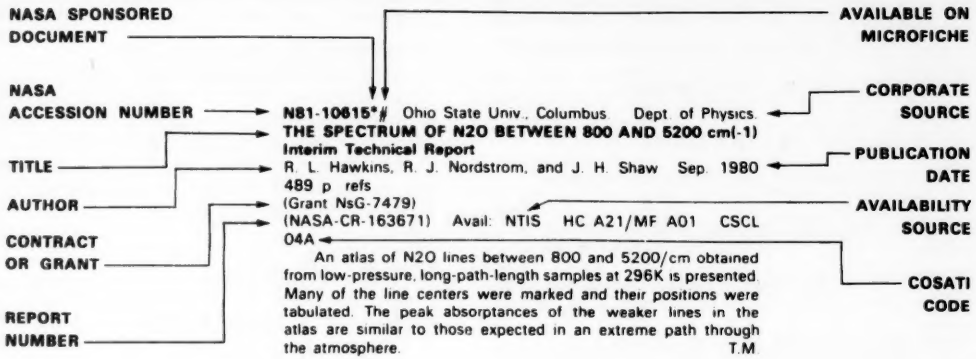
GENERAL

99 GENERAL 426

Note: N.A. means that no abstracts were assigned to this category for this issue.

SUBJECT INDEX I-1
PERSONAL AUTHOR INDEX I-67
CORPORATE SOURCE INDEX I-75
CONTRACT NUMBER INDEX I-91
REPORT/ACCESSION NUMBER INDEX I-95

TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
TITLE
Interim Technical Report
PUBLICATION DATE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AEROSERVOELASTICITY

M.A. Cutchins, Auburn University, School of Engineering, Dept. of Aerospace Engineering, *Auburn, Alabama* 36830 (DF641530; F08635-78-C-0027)

Air Force function - this work unit is established to develop an analytical capability to predict dynamic instabilities resulting from the influence of servo systems on aircraft flutter from a time domain base. Deficiency or opportunity - passive flutter studies alone will not define dynamic instabilities of aircraft. Objective - time domain based servo influences on the instability of an aircraft will be employed. How work contributes - this program will be used to define all future aircraft structural dynamic characteristics.

The techniques and procedures necessary to perform an aeroservoelastic analysis of a winged vehicle will be explored. Computer simulation of a flight control system using an all digital approach will be employed and coupled with the structural dynamic characteristics of USAF aircraft.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0002, LIFE SUPPORT EQUIPMENT RETRIEVAL PROGRAM (DA0C6897)

R.G. Pinkson, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0167)

To provide a technological data base concerning the physiological and biomedical aspects of the evaluation and injury correlation of life support equipment, identification of hazard protection problems associated with life support equipment and to provide conceptual design recommendations and criteria for the improvement of life support equipment.

Army aviation life support equipment involved in either injury causation or prevention, in field, are sent to USARL for biomedical and injury correlation evaluation. This evaluation assesses the effectiveness/deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred and the related human dynamics involved in the accident. The analysis is accomplished by the application of epidemiologic methods incorporating medically related engineering failure mode analysis, accident investigative procedures, forensic pathology, mathematical modeling and applied bioengineering research techniques. The resultant information and recommendations are provided to flight surgeons, users, safety organizations, project managers, and materiel developers concerning the medical and life science aspects of life support equipment, design, criteria and standard.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

1.0003, ANGULAR VIBRATION OF AIRCRAFT

W. Gibson, Anamet Lab. Inc., *Berkeley, California* (DF139980; F33615-77-C-3050)

Vibration adversely affects the performance of airborne optical systems which require high pointing accuracy. Aircraft structural vibrations are composed of linear and angular motions. Little is known of the latter and therefore the allowable angular motions among components of airborne optical systems in the low microradian range are difficult to define. To design such systems to operate with optimum performance and reliability requires the accurate prediction of angular vibrations. The objective of this work is to generate forced response prediction techniques for angular vibrations and to verify their accuracy with experimental data.

Techniques are available for estimating the low and high frequency forced linear vibration response of aircraft. Such techniques shall be considered for their limitations, flexibility and subsequent modifications resulting in angular vibration predictions. Unique combinations of these prediction techniques by optimizating their capabilities will also be examined to provide overall improvement in reliability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, STUDY TURBULENCE STRUCTURE

A. Demetriades, Ford Aerospace & Communications Corp., Aeronutronic Division, *Ford Rd., Newport Beach, California* 92663 (DF139560; F33615-77-C-3016)

The function of this program is to acquire detailed measurements of turbulent fluctuation properties and Reynolds stress under adverse pressure gradient. This effort is designed to improve the computational accuracy for turbulent flows on aerospace vehicles. Many of the Air Force current aerodynamic problems can be traced back to a lack of understanding of the fundamentals of turbulence. The technical objective is to systematically investigate the turbulence structure under adverse pressure gradients and to obtain the variation of Reynolds stress distribution under these conditions. The programs' payoff to the Air Force will be the ability to predict turbulent boundary layer phenomenon on supersonic aircraft.

The turbulent fluctuations will be measured experimentally by means of a hot wire anemometer and a laser Doppler velocimeter on a boundary layer over a curved ramp. Correlation of these measurements will be carried out to obtain Reynolds stresses. The final product shall be the variation of Reynolds stress distribution with pressure gradient.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRFOIL OPTIMIZATION BY ADAPTIVE CONTROL OF CAMBER AND THICKNESS

E. Levinsky, General Dynamics Corp., Convair Aerospace Div, *P.O. Box 1950, San Diego, California* 92112 (DN475202; N00014-76-C-0742)

The objective of this investigation is to demonstrate the feasibility of a self optimizing flexible technology (SOFT) wing which changes its shape (spanwise and chordwise distribution of camber and thickness) in such a manner as to optimize a given merit function. Such a wing will be able to automatically adapt itself to provide optimal performance throughout the whole

flight envelope. This technique will also overcome existing deficiencies in both analytic and wind tunnel methods for truly optimizing airfoil and wing geometries at high subsonic and transonic flight conditions.

The current phase of the research is being directed towards modification and refurbishment of the 1/6 scale semi-span SOFT wing wind tunnel model to correct deficiencies that were identified during the first wind tunnel test and to improve model reliability. When this redesign is completed, a second tunnel entry and test will be conducted with Air Force support at Arnold Engineering Development Center in tunnel 16T at transonic flight conditions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0006, DOD/NASA COMPOSITE STRUCTURE REPAIR HANDBOOK

S.N. Myhre, Northrop Corp., *3901 W. Broadway, Hawthorne, California* 90250 (DF143680; F33615-79-C-3217)

Advanced composite materials are being used in military aircraft structural applications. Although structural components made of advanced composites will experience service damage, the technology to economically and reliably repair this type structure is not generally available. This program will collect and compile available data related to the repair of advanced composite structure and, when needed, conduct limited research and/or development work to fill gaps in the technology. This handbook will be used by DOD and NASA to repair advanced composite structural components on aircraft. This program will provide a single document which will be used by all government agencies in a cost-effective manner to provide greater utilization time (less repair time) for needed military aircraft weapon systems.

Completed and ongoing composite repair R&D efforts will be reviewed and collated into a complete and usable handbook. Where additional limited development work and/or testing is needed to make the handbook complete, such work will be accomplished.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, IMPROVED METHODS FOR PREDICTING SPECTRUM LOADING EFFECTS

J.B. Chang, Rockwell International Corp., *International Airport, Los Angeles, California* (DF140670; F33615-77-C-3121)

MIL-A-83444 and MIL-A-8866b both require the capability to predict the effects of spectrum loading on aircraft safety and durability. The impact of these effects on such design parameters as cost, weight, material and configuration must be assessed at the earliest possible phase of the aircraft design cycle. Current state-of-the-art techniques involve detailed cycle-by-cycle analysis of complex flight-by-flight load histories. These analyses are time consuming and sophisticated, making them unsuitable for use in the preliminary design stage and very expensive to use for the detailed analysis stages. The objective of this effort is twofold: (1) develop more efficient and economical models for characterizing spectrum effects and (2) develop techniques for implementing the specifications at the preliminary design stage. Accomplishment of these objectives will permit economical, efficient application of safety and durability criteria throughout the life cycle of USAF aircraft.

A large experimental data base exists relative to spectrum loading effects on crack growth. The approach will be to assess this data base to isolate the significant parameters which characterize the spectrum effects at various levels of analysis such as preliminary design, force management, and detailed failure analysis. Methodology will be developed to relate the spectrum effects to damage accumulation. Emphasis will be placed on development of handbook methods as well as computer programs. results will be incorporated in the USAF damage tolerant design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, ADVANCED STRUCTURAL REPAIR FOR LOWER COST

A.L. Sanders, Rockwell International Corp., *International Airport, Los Angeles, California* (DF141300; F33615-78-C-3208)

An important element of the overall maintenance and repair of a weapon system is the refurbishment and/or repair of structural components. Frequently, excessive costs arise due to either basic structural design deficiencies or inadequate/outmoded repair methods. The objective of this effort is to devise innovative structural concepts and repair/maintenance techniques for selected high cost maintenance items to decrease both frequency of repair and cost.

Specific critical airframe and ground support equipment maintenance items from fighter, cargo tanker, or bomber aircraft will be selected for development of improved designs and/or repair techniques. The lower cost potential of these techniques will be demonstrated through prototype applications and the approach will be documented for possible AFLC implementation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, RESEARCH IN AERODYNAMICS

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0C5002)

To expand the technologies in those areas which are most likely to impact improved operational and cost-effectiveness, survivability and safety of future Army airmobile systems. Analytical and experimental studies are selected on the basis of a continual review of the Army's aviation objectives and assessment of those fundamental technological deficiencies which would prevent achievement of the desired objectives.

Rotary-wing research will be conducted through joint participation with NASA to develop or improve analytical tools, prediction techniques, and fundamental understanding related to basic fluid mechanics, rotary-wing airfoils, acoustics, rotary wing dynamics and control, and flight simulation.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0010, 2ND GENERATION COMPREHENSIVE HELICOPTER ANALYSIS SYSTEM

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0G2725)

The objective of this task is to develop and demonstrate a second generation comprehensive helicopter analysis system which is a system of methods for predicting loads aeroelastic stability and control, and performance for rotary wing aircraft of various sizes and rotor types. The system will be applicable in preliminary design and development support, and research activities. Accurate prediction is needed to reduce development risk for new helicopters, to prevent delays in deployment of new aircraft, and to reduce reliability and maintainability problems of operational aircraft.

A government-industry working group (GIWG) has been established to prepare specifications for the system and to define details of the approach to be taken. The majority of the work will be accomplished through contracts with industry (software firms) and grants to educational institutions. After the system is developed, it will be validated by correlation with experimental data. This program is fully coordinated with NASA rotorcraft research analysis and test plans. The rationale for this approach is to obtain maximum user involvement in the development of the system. Foreign state-of-the-art trends and potential threats to present and future systems have been considered in planning this task.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0011, AIRCRAFT EMERGENCY POWER SUPPLY
J.N. Foutz, U.S. Dept. of Defense, Navy, Naval Ocean Systems Center, Electronics Engineering & Sciences Dept., *San Diego, California* 92152 (DN988515)

Develop the criteria for a lightweight bi-directional power flow switching regulator power supply which can operate between a low voltage battery (emergency energy source) and the 270 volt DC generator bus. Bus power shall be converted to maintain the battery at optimum charge. Upon failure of the main generator, the unit shall convert battery voltage to 270 volt DC to maintain bus power continuity.

Develop optimized topology and performance goals for a bi-directional switching regulator power supply that will service a low voltage battery & a 270 volt topology in the design of an emergency power supply.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0012, V/STOL AERODYNAMICS
L.V. Schmidt, U.S. Dept. of Defense, Navy, Naval Postgraduate School, *Monterey, California* 93940 (DN998077)

Model the V/STOL jet reaction flow field including the presence of the aircraft shape, ground effect, cross winds and multiple jet configurations; increase the predictive capability of V/STOL related flow phenomena such as suckdown, hot gas reingestion and entrainment. These latter effects have a significant impact upon design analysis and evaluation for future Navy V/STOL aircraft.

(a) Theoretical: review existing modeling techniques for jet flows and extend concepts to the V/STOL environment. Develop computer techniques as an analytic tool, and correlate results with existing data, (b) Experimental: conduct appropriate experiments for confirmation of new modeling techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, FORWARD SWEPT WING V/STOL AIRCRAFT STUDY
D. Migdal, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN890210; N00019-79-C-0435)

Recent developments in composite structures technology have indicated that it should be feasible to develop a forward swept wing of comparable weight as an equivalent aft swept wing. Analysis and wind tunnel tests have shown the forward swept wing to have lower transonic drag, greater maneuverability and high natural spin resistance when compared with a conventional aft swept wing. In addition, the forward swept wing appears to offer added advantages for V/STOL applications. The objective of this work is to docuement the benefits of the forward swept wing concept applied to fighter/attack V/STOL aircraft.

The advantages of the forward swept wing concept will be evaluated initially through preliminary design studies, followed by small scale tests to determine suckdown losses (or gains) and control effectiveness using vanes in the jet blast. A preliminary simulator investigation of the estimated flying qualities, particularly with regard to translational/rotational coupling, will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0014, MODULAR LIFE CYCLE COST MODEL FOR ADVANCED AIRCRAFT SYSTEMS
B. Rachowitz, Grumman Corp., Aerospace Division, *S. Oyster Bay Rd., Bethpage, New York* 11714 (DF135570; F33615-76-C-3056)

Since operational support costs comprise such a large part of total life cycle costs, these relationships are needed in order to evaluate the cost impact of alternative candidate designs and to effectively conduct trade studies which compare the cost/performance advantages of these competing designs. The objective of this study is to determine specific parametric relationships between selected operational concepts, primary performance characteristics, and life cycle support costs which can be used to develop a model for estimating the operating and maintenance costs of future advanced military aircraft early in the design phase of the development program.

Study will be implemented to identify, analyze and quantify the relative cost sensitivity of a range of system parameters of the kind available early in the design process. Information derived will be used to generate parametric costing techniques and methodology for determining system support costs early in the design phase of an aircraft program. Computerized mathematical/statistical analysis models and techniques will be developed. Analytical tests will be formulated, capable of determining the degree of validity implicit in these models and the accuracy/adequacy of the methods developed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0015, DEVELOPMENT OF FULL VISUAL DISPLAY FOR TOTAL MISSION SIMULATION
R. Winoyka, Singer Co., *Binghamton, New York* 13902 (DF144440; F33615-79-C-3626)

One of the key thrusts within the AF flight dynamics laboratory is to develop the capability for technology evaluation in credible scenario using a total mission simulator. Currently, hardware is not available to provide the wide field of view and resolution needed for a large dome simulator of this type. The objective of this work unit is the development of a continuous 270 deg spatial presentation for out-the-window pilot visual displays. If this engineering development effort is successful, the capabilities of the total mission simulator will far surpass any simulator system presently considered in the areas of field-of-view and resolution.

The approach involves a contractual effort directed at the design and development of a continuous, 270 deg spatial presentation for out-the-window pilot visual displays in engineering flight simulators. The technique to be exploited considers the use of high output, color projectors, fixed in place to project on a spherical display screen, detailed terrain information. The phases involved in the subject effort are: a. Development and complete analysis of engineering laws governing this phenomena. B. Development and analysis of optical lens system for this engineering effort. C. Development of engineering design requirements for high light output project. D. Development of prototype system to prove/demonstrate the feasibility of the proposed engineering solution.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, LOW PROFILE ELECTRO-MECHANICAL CONTROL ACTUATOR FOR MISSILES
R. Feucht, Lear Siegler Inc., *Maple Heights, Ohio* 44137 (DF143310; F33615-79-C-3603)

This program addresses the capability to control high performance missiles. Current hydraulic and pneumatic missile actuators have deficiencies such as: shelf life problems, are difficult or impossible to pre-launch check, have low reliability and are usually expensive to maintain. The objective is to develop and demonstrate low profile, high temperature electro-mechanical (E-M) flight control actuators that will provide up to 3000 in/lbs of torque, frequency responses up to 30 Hz and having a temperature range of -65 to 600 deg/F. E-M actuators provide high performance missiles with high temperature operational capability, improved maneuverability, lower weight, cost and volume, checkability, simplified actuation equipment via eliminating complex hydraulic or pneumatic secondary power sources.

A design trade-off study will be conducted to define the best technical approach to achieve a E-M actuator having an optimum overall high performance capability, low weight, volume and cost and maintain a low profile configuration. Output of the study is to provide a viable gear train, electric motor and electronic control arrangements that will allow optional schemes for mechanizing the desired actuator. It is anticipated that a samarium cobalt permanent magnet type motor will be developed to drive the actuators. All components will be designed to perform at elevated temperatures. Initially, components will be fabricated and tested as developmental units and subsequently assembled as breadboard actuators and tested to

validate performance. Subsequent to breadboard performance validation, a final design will be established, fabricated and tested to demonstrate that the specified statement of work flight control requirements have been achieved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0017, COMPOSITE SPECIMEN FABRICATION AND TEST

R.T. Achard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF139700)

This work unit is supportive to preliminary design and evaluation of advanced structural composite materials and basic material processing techniques, and is to include activities related to construction and testing of standard specimens and representative structural geometries using advanced composite materials. The capability to explore technology under parallel investigation by civilian industry, on a much reduced scale, leads to a more thorough understanding and to some degree allows anticipation of problems related to technology development for Air Force aircraft structures application. The objectives of this effort are to perform in-house fabrication and assessment of payoff potential, through inspection and test, of composite structural concepts, arrangements, and geometries including bonded assemblies and hybrid assemblies where applicable. The in-house approach allows for direct dollar savings as well as indirect savings associated with more timely responses to current problems. Timely responses based on thorough understanding permits a more time- and cost-effective approach to the solution of problems inherent in advanced structural design and development.

Efforts within this work unit will include, but not be limited to, the following: fabrication of unique test specimens, analysis and test of composites in various simulated environments, fabrication of fracture mechanics coupons, development, fabrication and test of elastomeric tooling concepts, support of composite investigations by other laboratory agencies as requested, investigation of an automatic scanning dielectric spectrometer, for monitoring and improving composite cure cycle efficiency, creation and maintenance of displays illustrative of composite applications in airframes, and conducting of tours and presentations explanatory thereof as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, COMPOSITE STRUCTURES FABRICATION AND TEST

R.T. Achard, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144640)

This work unit is supportive to preliminary design and evaluation of advanced structural composite materials and basic material processing techniques, and is to include activities related to construction and testing of standard specimens and representative structural geometries using advanced composite materials. The capability to explore technology under parallel investigation by civilian industry, on a much reduced scale, leads to a more thorough understanding and to some degree allows anticipation of problems related to technology development for Air Force aircraft structures application. The objectives of this effort are to perform in-house fabrication and assessment of payoff potential, through inspection and test, of composite structural concepts, arrangements, and geometries including bonded assemblies and hybrid assemblies where applicable. The in-house approach allows for direct dollar savings as well as indirect savings associated with more timely responses to current problems. Timely responses based on thorough understanding permits a more time- and cost-effective approach to the solution of problems inherent in advanced structural design and development.

Efforts within this work unit will include but not be limited to the following: process improvements, tooling development (including investigation of ceramic and composite tools, and use of styrofoam for elastomeric tool molds), fabrication of 3-dimensional composite structures (hat sections, angles, etc.), use of chopped composite materials as filler-reinforcement, stitching of T sections, investigation and improvement of test methods, creation and maintenance of displays illustrative of composites applications in airframes, and conducting of tours and presentations explanatory thereof as required.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, UNIQUE ELECTRONIC MEASUREMENT SYSTEMS FOR SIMULATION TESTING OF MULTI-MISSION MILITARY VEHICLE FROM LOW/HIGH SPEED FLIGHT REGIMES

J.H. Bieber, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF120720)

Advanced strategic flight vehicles will require configuration design changes to independently provide combined flight characteristics such as maneuverability, speed, control and stability throughout the entire environment that the vehicle is subjected to in flight. A comprehensive understanding of the aerodynamic flow characteristics that these vehicles must encounter during extensive realistic operational testing is lacking but is essential for optimum design. Overcoming deficiencies most effectively and rapidly can be accomplished by the testing of proposed aerodynamic configurations in ground simulation test facilities. This requires the measurement of such aerodynamic parameters from test models as force pressure, temperature and heat rates. Frequently commercial electronic instrumentation will not provide the quality of data required. The effort is to develop the circuitry necessary to effectively interface equipment into systems that meet the desired measurement goals in these test facilities.

All available data on pilot rating and human response measures will be collated into functional expressions of flying qualities. Computer analysis - analog and digital - will be implemented to assure rapid and accurate data analysis and formulation of models for estimation of flying qualities given vehicle dynamics and flight condition. Methods utilized in the VTOL program will be extended for conventional vehicles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0020, ELECTRONIC AND DATA SYSTEM DEVELOPMENTS FOR AERODYNAMIC TESTING

D.V. Breitenbecher, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141560)

The conception and generation of effective weapon systems must first be preceded by extensive operational testing in aerodynamic wind tunnels to achieve optimum design. These facilities include the 50 megawatt RENT and HTL facilities, the TGF and others. The objective of this work unit is to apply unique developments in electronic circuitry and systems to improve performance, reliability and cost-effectiveness of the existing facility data systems as well as those data systems now under development. The application of these techniques to control, monitor, and read facility parameters as well as control the facility will improve the performance, reliability, and cost-effectiveness of the facility.

The facilities will be screened to determine the improvements required and the priority of these improvements. Data systems of existing facilities will be updated via the application of new microelectronic and computer technologies. The monitoring, reading, and control of critical facilities will be updated by application of the above technologies. Where applicable these techniques will be used as new facilities are planned and developed. New devices for facility diagnostics and control, such as the electron beam, will be designed, tested, and installed to increase data reliability. Modern and more reliable hard wired systems will be developed in-house or purchased, tested and installed where applicable.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0021, ADVANCED AIRBORNE DIFFUSERS

S. Hasinger, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143660)

Airborne laser weapons systems depend on a high pressure recovery diffuser in order to discharge the laser exhaust gasses into the atmosphere. The effectiveness of the diffuser is crucial to the operation of these weapons systems. Present laser diffuser systems do not satisfy all the requirements established by AFWL, Kirkland A.F.B., N.M. It is the objective of this research to explore the potential of novel diffuser concepts for their eventual incorporation into an actual airborne laser weapon system. The general validity of these concepts has been proven in previous investigations at the AFFDL, Wright-Patterson A.F.B., Ohio. This research is conducted in direct coordination with AFWL, which is charged with the responsibility of developing various forms of airborne laser weapon systems.

Research will be carried out in the AFFDL Mach number six high Reynolds number wind tunnel on a single stage of the slanted cascade diffuser. The radial outflow diffuser will be tested in a Mach number two and three environment at a Reynolds number of ten to the fifth. In both cases the result will be a light, compact diffuser with a high pressure recovery and instant re-start capability. The slanted cascade diffuser is intended for use in the gas dynamic laser weapon system while the radial outflow diffuser is to be employed in the chemical laser system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, EMERGENCY CREW ESCAPE SYSTEM DESIGN AND PERFORMANCE ASSESSMENT

L.A. Jines, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF136580)

The fatality rate among USAF ejectees from military aircraft is increasing. This is true in spite of many apparent improvements to operational ejection seats. Because of cost and other practical physical limits an ejection seat system is never fully tested. Modifications are then incorporated with similar lack of demonstration of capability. Comprehensive technical evaluation capability needs to be developed to insure that the limited testing is most effective. The objective of this effort is to develop a reliable and valid analytical capability for military crew escape systems to use in design of escape systems, accident investigations, performance evaluations, etc. Extensive effort will also be expended toward the development of a crew escape concept for safe escape while under high acceleration loads.

Emergency crew escape statistics will be analyzed to determine conditions at ejection for possible indication of a pattern to resulting injuries, fatalities or successes. A companion analysis of current emergency crew escape systems to include effects of individual components on total system performance will be conducted. These analyses will be correlated to define current system limitations and problems. Refined data on the mechanical properties of escape systems will continue to be measured, including aerodynamic properties, weight and balance, force, dimensional and functional. A computer math model depicting the detailed operation of the system is generated, validated and applied during analyses of various crew escape systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, NASTRAN COMPUTER PROGRAM

J.R. Johnson, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF132120)

Structural stength, integrity, service life and minimum weight are vital concerns in the design and analysis of aerospace vehicles to insure that they perform the intended mission. The objective of this effort is to develop efficient general purpose finite element structural analytical methods that will directly support the design and analysis of structures for strategic, tactical, training and logistic aerospace vehicles. The successful accomplishment of this objective will insure the ready capability to provide the analysis support for aerospace systems, such as the B-1, CCV and RPV, with a minimum of elapsed time, and to provide a NASTRAN focal point for the WPAFB NASTRAN users group.

Coordinate the efforts of the users group. Provide consultation and direction as required to use, maintain and modify the computer program. Serve on the HQ NASA NASTRAN Advisory Group (NAG).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, SIMULATION OF BIRD IMPACT ON AIRCRAFT TRANSPARENCIES

J.P. Barber, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF137660; F33615-78-C-3402)

Air Force flight missions involve high speed, low altitude operations. Under these conditions, bird impacts on aircraft transparent crew enclosures pose a significant hazard and have resulted in unacceptable losses of aircraft and aircrew. The objective of this work unit is to develop math models for bird impact loads on aircraft transparencies. Utilization of existing computer methods for transparency design is contingent upon the availability of such bird loading models. These computer design methods will allow design of transparencies having improved bird resistance and will provide significant savings by reducing the costly empirical development historically required for transparency design. The availability of transparencies having improved bird resistance will reduce, to an acceptable level, the bird-strike hazard to USAF aircraft.

Efforts under this program will include upgrading the test and data acquisition capability of an air gun test facility, validation of an available math model for large bird impact, study of bird attitude effects on impact loads and investigation and validation of a substitute bird material to be used in impact testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, BLOCK PROGRAM PERSONNEL PROTECTION AND SURVIVAL

D.N. Desimone, U.S. Dept. of Defense, Navy, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate, *Warminster, Pennsylvania* 18974 (DN681085)

To provide naval aircrew personnel with the operational capability to perform aircrew tasks with maximum efficiency. The continuing improvement in airborne weapons systems demands increased skills from the crew, and increases the potential hazards resulting from the enhanced aircraft performance envelope. Because of this continuing improvement in aircraft performance capability, there is a continuing need to advance aircrew protection.

Development efforts to meet the primary objectives include the experimental development of or search for new materials, components, techniques of fabrication, subsystems and systems. Efforts will vary from the fundamental to the sophisticated application of the principles of engineering and physiology.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0026, PROPULSIVE-LIFT POWERED RESEARCH MODEL TESTS

P.D. Whitten, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF142540; F33615-78-C-3032)

Recent wind tunnel tests and studies have indicated that significant STOL and maneuver performance benefits are possible as a result of propulsive aerodynamic concept application for advanced tactical aircraft. In particular, the combination of both spanwise blowing and upper surface blowing, e.g. the vectored engine-over-wing (VEO-wing) concept has been shown to provide improvements over the entire angle of attack range at subsonic and transonic speeds. Unpowered configuration model tests have indicated that viable design arrangements, which do not degrade performance, are possible; however, the powered data base is somewhat deficient. The objective of this effort is to expand the powered data base by experimentally investigating engine nacelle location, nozzle arrangements and control surface variations applicable to realistic advanced tactical aircraft configurations. Results will be available for assessment of the STOL and maneuver performance of air-to-surface and air-to-air fighters.

Testing will be conducted in the NASA/LARC 16 foot transonic and V/STOL wind tunnels using a contractor-owned

powered research model. Longitudinal aerodynamic/stability and control data will be obtained over the angle of attack range of minus 4 to 40 degrees and at Mach numbers from low speed to 1.2. Variations in nacelle location, nozzle arrangement and control surface deflections will be investigated at typical fighter aircraft engine operating conditions. The experimental data will be analyzed to verify the propulsion/aerodynamic benefits.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, HT PP 76-12 - INVESTIGATION OF LIFE PREDICTION TECHNOLOGY FOR SMALL TURBINE ENGINES

Unknown, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0E3833)

To investigate current techniques for determining expected life of small turbine engine components; to identify existing voids in technology which, if filled, could provide the Army and industry with more reliable and effective life prediction tools. This investigation could result in further work to pursue improved life prediction techniques and allow better component design capability for particular mission requirements, longer mean-time-between-overhauls with equivalent flight safety, and reduction of total engine hardware required.

Utilizing information from the literature, government and industry, this program will investigate various stress analysis theories (2-D, 3-D) and metal temperature calculation techniques from the standpoint of usability, effectiveness and accessibility of computer codes, stress concentration factors and coating effects, etc., and identify potential improvements which could advance life prediction technology. The output of this program will include the current status of life prediction relative to Army needs, for future work, where feasible, to fill the voids in technology.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0028, AIRCRAFT DIGITAL INPUT CONTROLLED HYDRAULIC ACTUATION AND CONTROL SYSTEM

G. Raymond, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF461320; F33615-77-C-2034)

The objective of this program is to establish and demonstrate hydraulic actuation system techniques that respond directly to digital input commands. The techniques will be applicable to continuous duty actuation functions such as air induction, engine inlet vanes, engine after-burner nozzles and flight controls.

A potential DEHA aircraft application will be selected aimed at establishing performance and design criteria. An analysis of promising advanced hydraulic actuation techniques implementing multimode electronic digital inputs, will be conducted to establish its applicability to future aircraft. Based on these results, a full scale DEHA prototype will be designed, fabricated and tested to verify compliance to performance and durability requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NAVIGATION - SUPPORT FOR SATELLITE NAVIGATION SYSTEMS AN/WRN-4

J. Stelle, Magnavox Government & Industrial Electronics Co., *1313 Production Rd., Fort Wayne, Indiana* 46808 (DN123404; N00014-77-C-0184)

Advance design satellite navigation equipments model AN/WRN-4 have been procured in limited quantity to provide high accuracy, all weather, global positioning capability required to support at sea R/D efforts. These systems are fully automatic, completely integrated, compact in size and lightweight to facilitate transfer between users while preserving high reliability and maintainability. Centralization of spare parts and repair facilities for those sophisticated and unique equipments assures continued quality control, accurate performance history and minimum investment in back-up spares.

The investigator: will provide a bonded warehouse for maintaining a pool of spare parts; will provide a supervisor to maintain liaison with equipment users in equipment troubleshooting and spare parts replacement; will maintain inventory records, parts failure analyses and equipment performance data; will ensure timely repair to faulty parts, their inspection and their return to stock in accordance with proposed procedures; will maintain three GFE model AN/WRN-4 (MX706MA) equipments for emergency back-up equipments spares; and provide field assistance and operator training.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CARBORANE BURNING RATE MODIFIERS FOR SOLID PROPELLANTS

W.E. Hill, Auburn University, School of Chemistry, Dept. of Chemistry, *Auburn, Alabama* 36830 (DN590583; N00024-75-C-5318)

To perform research on carborane compounds for use as propellant burning rate catalysts. Three main problems will be investigated; (1) possibility of migration from the propellant, (2) undesirably high melting points, and (3) low yield synthesis.

To prevent migration, existing binders will be modified by using carboranyl plasticizers which react with double bonds of the polymers on curing. Hydroxy terminated polybutadiene (HTPB) and carboxy terminated polybutadiene (CTPB) polymers will be reacted with functional carboranes to make polymers containing boron which should not migrate easily. Silyl carboranes containing Si-Si bonds or Si-C bonds will be synthesized. These compounds should yield high burning rates with less carborane which should be less volatile. Difunctional carboranyl isocyanates and epoxides for use as curing agents will be synthesized. What effect a Lewis base has on the reaction rate activation energy and yield of ortho carborane will be determined. Carboranes will be synthesized from acetylenes for improved yield.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

3.0002, ELECTRON- AND PHOTON-MOLECULE COLLISIONS WORKSHOP

V. McKoy, California Inst. of Technology, Graduate School, Dept. of Chemistry, *1201 E. California Blvd., Pasadena, California* 91109 (DF053010; AFOSR-78-3682)

AF function - this workshop is relevant to RO 3.2, optical effects in communication, surveillance, navigation, and detection systems and RO 6.3, electromagnetic weaponry. Deficiency - present and future efforts in gas-laser development, combustion, atmospheric physics, as well as other energy-related fields, rely on a quantitative understanding of the electron and photon scattering processes for a variety of small molecules. The need for quantitatively accurate electron- and photon-molecule scattering cross sections is putting stringent demands on present theoretical methods. Objective - to assess the scope of those methods which are presently being used in the study of electron- and photon-molecule collisions, to identify the key advantages and limitations of the various methods and to see which techniques are best suited for a quantitative study of the important problems in molecular scattering. Contribution - the Air Force will benefit from identification of theoretical methods best suited to particular calculations and from the advance in techniques resulting from research stimulated by this workshop.

Approximately thirty-five scientists will participate in an intensive four-day workshop on electron-molecule scattering and photoionization. This group will be representative of both the numerical and the basis set expansion approaches to electron- and photon-molecule collision problems. The first two days will be devoted to information exchange. This will consist of more or less formal lectures on the numerical and basis set methods. During the latter two days of the workshop the participants will break up into smaller groups each of which will discuss one or two problems in some detail. The participants will also be asked to provide written reports detailing the content and conclusions of these sessions. These reports along with a text of the invited presentations, will be organized into a report which will provide a definitive summary of current work in the area and the indications of the direction that future research will take.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, GAS GENERATOR FUELS STUDY

L. Schipper, Signal Co. Inc., Airesearch Manufacturing Company, *1010 Wilshire Blvd., Los Angeles, California* 90017 (DF190710; F29601-77-C-0074)

Identification of viable alternative(s) to hydrazine for use in gas generators required to drive high power airborne power units.

Fifteen fuels are to be investigated for possible use in high power APU systems. The contractor will develop a parameteric weighting system for selection of candidate fuels. A detailed fuel specification and duty cycle are provided for development of the weighting system. The range of interest is from 3,000 to 20,000 shaft horsepower.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

3.0004, BASIC IMPROVEMENTS IN SUBSTRATE INP MATERIAL 16041-EL

G.A. Antypas, Varian Associates Inc., *611 Hansen Way, Palo Alto, California* 94303 (DA0G8991; DAAG29-79-C-0009)

To study growth parameters and processes which lead to high quality of indium phosphide single crystals. Relevance - InP is a promising material for active high frequency devices (in excess of 20gHz) and for electrooptical applications such as photocathodes or photodiodes.

Emphasis will be placed on growth, characterization, and physical chemistry of high throughput, high pressure pullers for polycrystalline and single crystal material. Sources of defects and precipitates will be studied and eliminated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, SURVEILLANCE - BEHAVIOR OF INORGANIC MOLECULAR SOLIDS SUBJECTED TO MAGNETIC FIELDS AND TO LIGHT

E.R. Bernstein, Colorado State University, School of Science, Dept. of Chemistry, *Fort Collins, Colorado* 80523 (DN675016; N00014-75-C-1179)

Solid state devices such as transistors and radiation detectors are widely used in the Navy in communication, energy conversion, and surveillance. Molecular crystals, such as the inorganic molecular crystals to be investigated here, interact strongly with light and with magnetic fields and are therefore excellent candidates for use in solid state devices. It is the purpose of this research to investigate the interactions among the molecules and the energy transfer processes in inorganic molecular crystals with a view toward producing improved solid state devices.

Optical and zero field paramagnetic resonance techniques are being used in an investigation of intermolecular interactions, energy transfer mechanisms, and exciton kinetics in inorganic molecular crystals. Environmental effects on molecular energy levels within the crystals will be characterized. The molecules chosen for investigation include rare earth and actinide borohydrides and borazine (which has physical properties similar to those of benzene). A low temperature, high resolution zero field paramagnetic resonance investigation of ground and excited states of f electron crystals will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0006, THEORY OF MANY-BODY PROCESSES IN CHEMICAL PHYSICS

W.P. Reinhardt, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (CHE80-11442)

This grant supports research under the Quantum Chemistry Program for theoretical studies of the interaction of radiation with matter. Of particular interest are the time dependence of multiphoton ionization and the dynamics of energy flow within vibrationally or electronically excited molecules during and following their interaction with intense laser radiation. Theoretical modelling of these processes requires development of new theory.

Professor Reinhardt will investigate the relationship between quantum and classical mechanics in cases where the classical motion becomes chaotic. This includes: Work on multidimensional semiclassical scattering approximations; Models for three-photon ionization of atomic hydrogen and photodetachment of H-; Investigations of two-electron photojection using classical invariants; and Development of a theory of charged particle scattering in intense laser fields.

An objective of the research is to provide a better understanding of energy regions which are of current chemical interest, from intramolecular dynamics to perturbed atomic spectra.

This is a renewal of research currently supported by NSF grant CHE 7716307 to the University of Colorado at Boulder.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, THE ACOUSTIC EMISSION FROM CRYSTALLINE MATERIALS

S.H. Carpenter, University of Denver, School of Engineering, Dept. of Metallurgy, *2115 S. University Blvd., Denver, Colorado* 80210 (DF049530; AFOSR-77-3395)

AF function - aircraft structures subject to static and dynamic loads are vulnerable to the initiation and growth of defects (e.g. cracks) which may lead to structural failures. Opportunity - often the growth of these defects gives rise to acoustic emission which can be detected and analyzed to provide a nondestructive evaluation (NDE) of the severity of the defect growth. Objective - the objective of this research is to correlate the characteristics of the acoustic signal to the type and severity of the defect origin. How work contributes -acoustic emission is a particularly desirable (NDE) concept because the growing defect 'calls out' its location, and one does not have to search for the defect.

The characteristics (e.g. wave shape, frequency components, amplitudes, etc.) of the acoustic emission will be related to the structural and metallurgical properties of the material and to the effect of stress states acting on the defect. Verification that a particular source is responsible for a characteristic signal will be obtained from other independent measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, MODIFIED GRAPHITE/EPOXY COMPOSITES

J.P. Reardon, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880403)

The objective is twofold (1) to reduce the liability stemming from the use of the electrically hazardous carbon fibers in composites used in aircraft construction, and (2) to increase the electromagnetic interference (EMI) shielding of such composites in airplanes.

(1) The electrical threat associated with the escape of carbon fibers from burning composite on an aircraft could be eliminated by insuring that the otherwise refractory fibers would be consumed in a fire. To this end, carbon combustion promotors are added to the composites and their effectiveness is

evaluated in an NRL-designed test chamber, in addition to flame tests and TGA. (2) We are attempting to improve the EMI shielding of graphite/resin composites by selecting highly conductive graphite fibers and further increasing their conductivities by forming stable intercalation compounds. These intercalated fibers are then incorporated into the composites being fabricated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0009, ELECTROTRANSPORT IN THIN FILMS
R.E. Hummel, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (DF042830; AFOSR-76-2963)

AF function - microwave solid state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Deficiency - the occurrence of metal migration effects at elevated temperatures for various contact metal systems causes failure of these solid state devices and thus reduces the reliability of systems employing these devices. Objective -the objective of this research is to obtain an understanding of the mechanisms which are operating in the electrotransport of one-component and dilute alloy thin metal films. How work contributes - an understanding of the electrotransport mechanisms and the factors which promote or retard this process will allow for further improvement in metallizations for microwave solid state devices.

The effects of microstructure, temperature gradients and solute additions upon the electrotransport response of thin films made of a variety of metallic elements such as gold, silver, copper and aluminum will be studied systematically. For at least one combination of solute and solvent that is observed to produce reversal in the failure site, the solute concentration will be varied in a series of samples to see if it is possible to find an intermediate concentration that will balance the two opposite mass flows to produce a very long lifetime.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0010, CHEMISTRY OF EPOXY CURING REACTIONS
N.S. Schneider, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G4763)

To characterize the curing behavior and determine the mechanism of cure of epoxy resin systems of Army interest. To improve the reproducibility and reliability of epoxy resins used in structual, fiber-reinforced composites. Major thrust - aircraft survivability.

Model epoxy resin systems will be formulated containing the principal components which have been identified in two commercial resins of Army interest, SP250 and RAC7250. The study will emphasize the use of purified components for reaction and curing mechanism studies. In certain cases, analog model reactants will be used to provide soluble products which can be separated for complete identification. Methods will include differential scanning calorimetry (DSC), torsional braid analysis (TBA), fourier transform infrared spectroscopy (FTS-IR), and high pressure liquid chromatography (HPLC).

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0011, MODEL NETWORK POLYMERS 16389-C
C.W. Macosko, University of Minnesota, St. Paul Campus, Graduate School, Dept. of Chemical Engineering & Materials, *St. Paul, Minnesota* 55101 (DA0G9042; DAAG29-79-C-0091)

To develop a better relationship between the elastic behavior of polymer networks and their molecular structure and topology. Relevance - the development of relationships between the extent of reaction and resulting structural properties will be applicable to ongoing Army studies on epoxy resin systems and other crosslinked materials used in the fabrication of composites and in the development of elastomers. Results will also have application to Army programs concerned with solid propellants.

Well characterized endlinked and randomly crosslinked polydimethyl siloxane networks will be formed by a vinyl crosslinking reaction. Stress-strain relations will be obtained as a function of the network structure. The entanglement plateau will be independently studied on long linear PDMS chains.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0012, NAVY VEHICLE DESIGN AND CONSTRUCTION - RARE EARTH ADDITIONS TO TITANIUM ALLOYS
C.R. Whitsett, McDonnell Douglas Corp., Research Laboratory, *P.O. Box 516, St. Louis, Missouri* 63166 (DN675493; N00014-76-C-0626)

Titanium alloys are important lightweight structural materials for use in aircraft and ships. Alloy microstructure and mechanical properties can be controlled by effective use of alloying and processing. This research will explore the effects of rare-earth additions to titanium alloys.

The effects of rare earth additions to Ti-8Al, Ti-10Al and Ti-100 alloys will be determined. Erbium and yytrium additions (0 to 0.5 wt. percent) will be introduced to the alloys and structural changes correlated with mechanical properties, particularly tensile strength and ductility, toughness, hot workability, and creep strength.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0013, COMPATIBILITY OF LUBRICANTS WITH ADVANCED BEARING AND GEAR MATERIALS
R. Valori, U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center, *1440 Pkwy. Ave., Trenton, New Jersey* 08628 (DN796811)

To assure the availability of lubricant/steel combinations for future propulsion systems which have optimum reliability with respect to bearing and gear performance.

Candidate bearing steels in combination with advanced ester lubricants will be evaluated for their rolling contact fatigue, scoring, friction and wear characteristics on two bench testers, namely the rolling contact (RC) fatigue machine and geared roller test machine (GRTM). The test will cover a range of temperature, load, sliding and rolling conditions. In addition various ratios of elastohydrodynamic (EHD) lubricant film to composite surface roughness will be run to determine the scalability of this factor to various lubricant/steel combinations. At least ten different bearing steels will be used in the program over a four year period. These will include four case hardened steels, three wrought steels. Any promising other new steels which become available during the course of this program will also be evaluated. Those which are corrosion resistant steels will be evaluated for their corrosion resistance by a modified ASTM test method. All tests will be compared to HERCOLUBE A lubricant/M50 steel as a baseline.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Material Command

3.0014, INTERATOMIC POTENTIALS TO STUDY PHYSICAL PHENOMENA IN ALLOY SYSTEMS
E.S. Machlin, Columbia University, School of Engineering, Dept. of Mining Metallurgy & Mineral Engineering, *351 Engineering Ter., New York, New York* 10027 (DMR80-04237)

Interatomic potentials applicable to alloys will be used to computer-simulate the segregation to grain boundaries in body-centered cubic and face-centered cubic iron of certain interstitial solutes (O,C). Computer simulation of a tensile test across various segregated grain boundaries will be conducted to evaluate the ideal fracture work of segregated and non-segregated grain boundaries. The effect of electro-negativity difference on the synergistics of grain boundary segregation and structure for ternary alloys will be evaluated via computer simulation. Improved lattice energy functions will be developed that will facilitate computer simulation of defects in alloys and will be used to determine the effect of quadrupole polarizability upon grain boundary structure and segregation parameters in alloys. The

possibility of predicting phonon dispersion curves for homoelectronic alloy phases will be evaluated. Similarly, the possibility of predicting phonon dispersion curves for transition metal (T)-sp element (X) alloys will be evaluated. This is a continuation of research previously funded under NSF Grant DMR77-08667.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0015, OXIDATIVE AND PHOTOCONDENSATION OF PEPTIDE AND NUCLEOTIDE BONDS USING HCN AND HCN OLIGOMERS

J.P. Ferris, Rensselaer Polytechnic Inst., School of Science, Dept. of Chemistry, *110 8th, Troy, New York* 12181 (CHE79-24364)

This project is in the area of synthetic organic and natural products chemistry. HCN was a likely starting point for the synthesis of biomolecules on the primitive Earth. Previous studies established that purines, pyrimidines and amino acids are released on hydrolysis of HCN oligomers. The emphasis in the current research is the utilization of HCN and HCN derivatives for the condensation of amino acids and nucleotides to oligomers, the next stage of prebiotic synthesis after biomolecule formation. The clay-catalyzed formation of peptides and nucleotides is being investigated using HCN and a tetramer of HCN (diaminomaleonitrile) as energy sources. The catalytic properties of montmorillonite, in which the non-exchangeable iron is present as Fe (III) and Fe (II) is being studied. Two different oxidation states are being investigated because the oligomerization of HCN follows markedly different pathways depending on the oxidation level of the iron in the clay. A second approach to prebiotic peptide and nucleotide formation utilizes the energy of the light absorbed by HCN oligomers in the 200-400 nmr region. Reactions with simple enaminonitriles suggest that the nucleophilic addition of amino acids and nuleotides to the HCN oligomers should be promoted by UV light. HCN oligomer adducts, in which the carboxylic acid or phosphoric acid groups are activated, will be formed. These adducts should undergo facile reaction with nucleophiles to form peptides and nucleotides. The work is a continuation of research supported by NSF grant, CHE 7611000.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0016, QUATERNARY ALLOY FOR MICROWAVE MESFETS

J.W. Harrison, Research Triangle Inst., *P.O. Box 12194, Research Triangle Park, North Carolina* 27709 (DF047650; F49620-77-C-0062)

AF function - microwave solid state electronic devices are essential components of Air Force electronic countermeasures, communications, and signal processing systems. Opportunity - steady progress has been made in the development of high performance microwave devices using III-V binary compounds. It is expected that still further improvements, especially in the quest for higher operating frequencies, can be obtained by developing III-V quaternary material systems for use in the fabrication of microwave devices. Objective - the objective of this research is to develop the GaInAsP quaternary material system so that it will be useful for the fabrication of superior microwave field effect transistor. How work contributes - this work will contribute to the state of the art in microwave materials by developing the promising GaInAsP material system.

Liquid phase epitaxial techniques will be used to grow layers of GaInAsP on an InP substrate. Buffer layers will also be grown on some of the samples in order to shield substrate effects from the active layer. Various degrees of super cooling will be used in order to maximize the ordering of the quaternary alloy. The degree of alloy ordering and basic structural information concerning the layers will be obtained from transmission electron microscopy and x-ray diffraction techniques. These techniques will also be used to determine the structure of the alloy-substrate interface in order to insure that lattice matching has occurred. Schottky barrier profiling will be used to measure carrier density versus depth in the epitaxial layer. Resistivity and low field mobility will be measured as a function of temperature by vander Pauw techniques. Velocity-field characteristics will be measured by observing low repetition rate current-voltage pulses and by a direct time-of-flight measurement. When device quality material can be grown, actual field effect transistor devices will be fabricated. A systematic search will be made to find suitable ohmic and non-ohmic contact materials. When devices are made they will be characterized by their static, low frequency, and high frequency characteristics. From all of the above steps it will then be possible to correlate device performance with the properties of the materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0017, ENVIRONMENTAL IMPLICATIONS OF ALTERNATE FUELS

T. Jackson, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF409540)

To determine the changes in the quality and quantity of pollutants emitted by various blends of potential AF alternate jet fuels when burned in three different combustor types or utilized in various AF fuel handling systems.

Up to twelve different blends of potential AF alternate jet fuels will be burned in three different combustor types (low pressure can, high pressure can, and high pressure annular) to determine the changes in the quality and quantity of emitted pollutants (NOx, CO, smoke, and UBHC). Certain physical and chemical properties of the fuel blends will also be determined. The work will be accomplished by the AFAPL through multiple contracts with industry. The appropriate AFAPL JONs are as follows. 30480581 (low pressure can), 30480584 (high pressure annular), and 30480595 (high pressure can). A CEEDO/AFAPL technical report will be published for each of the anticipated three contracts to be performed during this program.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

3.0018, CONTINUOUS FIBER REINFORCED THERMOPLASTIC COMPOSITE MATERIALS

Unknown, Boeing Co., *P.O. Box 16858, Philadelphia, Pennsylvania* 19142 (DA0G4791)

The use of continuous fiber reinforced thermoplastic (CFRTP) composite materials is currently being accepted by the aerospace industry for application in secondary structures. These CFRTP materials are easily formed by conventional thermoforming equipment. Past work performed by Boeing on polysulfone based CRFTP materials have indicated a decrease in mechanical strength as a result of the thermoforming process as well as a solvent resistance problem. The objective is twofold- (1) to characterize the effect of thermoforming processing condition on the mechanical properties of polysulfone based CFRTP materials and 2) to determine the effect of real life solvent testing on the mechanical properties of polysulfone based CFRTP materials.

Panels of devlar/polysulfone and devlar/PKXA will be fabricated and thermoformed under various processing conditions. Test specimens will be obtained and evaluated for their mechanical properties. Sandwich structures of devlar/polysulfone and devlar/PKXA will also be fabricated and subjected to different solvent conditions typical of aircraft cleaning solutions. Specimens will be tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0019, REAL-TIME DAMAGE MODES IN CARBON-CARBON COMPOSITE MATERIALS

P.H. Francis, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DN775516; N00014-77-C-0510)

Carbon-carbon materials are used in propulsion and reentry components of advanced strategic systems. Failure modes and mechanical properties are significantly affected by initial defect

and flaw distributions and subsequent progressive damage under load. Significant damage (beyond the initial damage) can occur throughout the part under load before failure occurs. This research program will identify damage modes/mechanisms and subsequent constituent failure. Residual stresses, especially in circumferentially woven carbon-carbon materials, may significantly affect failure/damage behavior.

A significant number of carbon-carbon material test specimens will be evaluated. Test methods will be developed to utilize partial ring test specimens. Residual strains will be evaluated. Acoustic emission and scanning electron microscopy techniques will be used.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0020, HIGH ENERGY FUEL

W.W. Wimer, Southwest Research Inst., *8500 Culebra Rd., P.O. Drawer 28510, San Antonio, Texas* 78228 (DA0P3627; DAAK70 78 C 0001)

Develop energy-augmented fuels for Army combat/mobility surface and air vehicle power plants.

Fuel-formulation and single-cylinder engine studies are being conducted to determine feasibility of using a carbonaceous fuel system for battlefield use. High-volumetric-energy conventional type liquid fuels and carbon/carrier-fluid pastes and slurries are being examined for energy effectiveness and overall fire safety potential.

SUPPORTED BY U.S. Dept. of Defense, Army, Mobility Equipment Research & Development Command

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, MISSILE TECHNOLOGY/HYBRID MICROELECTRONICS TECHNOLOGY - MISSILE SUBSYSTEM HYBRIDIZATION

G.D. Little, U.S. Dept. of Defense, Army, Missile Research & Development Command, Advanced Systems Development & Manufacturing Technology Dir., *Redstone Arsenal, Bldg. 5400, Huntsville, Alabama* 35809 (DA0G1025)

The objective of this program is to develop and demonstrate methods of applying microelectric technology to be the concept, design, fabrication of missile systems. The second objective to quantitatively identify and improve heat removal methods of hybrid microelectronic circuitry.

A digital autopilot has been selected as the demonstration vehicle. This system has been designed and partitioned into hybrids. The hybrids and their supporting and interconnecting structure have been designed and fabrication is 98 percent complete. Redesign of digital autopilot as a result of the environmental and flight test will be completed and updated flight models will be fabricated and tested.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Advanced Systems Development & Manufacturing Technology Dir.

4.0002, THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS

K.R. Sarma, Motorola Inc., Dept. of Solar Energy, *3102 N. 56th St., Phoenix, Arizona* 85008 (2361; ET-78-C-03-2207)

The objective of this research program is to advance the development of thin film polycrystalline silicon solar cells with a view toward achieving photovoltaic conversion efficiencies greater than 10% at a cost of $0.30/watt or less (in 1975 dollars) by 1986. The approach includes deposition of microcrystalline silicon films efficiently using an energy beam, separation of them from the temporary substrates using the TESS technique, and grain enhancement by the RTR laser recrystallization followed by solar cell fabrication. Tasks for the current year are to: (1) optimize deposition parameters and substrate parameters for producing small grain self-supporting silicon films approximately 25 cm long; (2) fabricate large grain silicon films by RTR laser recrystallization; and (3) fabricate solar cells and evaluate their performance.

SUPPORTED BY U.S. Dept. of Energy, Div. of Solar Technology

4.0003, ELECTROMAGNETIC ANISOTROPY

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AF function - the Air Force functions of surveillance, reconnaissance, communication, command and control, weaponry, navigation and guidance require coherent light generation, modulation, transmission and detection, and optics associated with these applications. This research will address aspects of stabilized sources and anisotropy in the speed of light. Opportunity - the proposed work impacts Air Force interests. The work is a follow-on to earlier efforts at the University of Arizona directed toward increasing the accuracy of the measurement of the speed of light by several orders of magnitude. Objective - this work will undertake an experiment to greatly reduce the uncertainty of a Michelson-Morley type experimental test for anisotropy in the speed of light. Contribution - this work will provide techniques for ultra-stable lasers as well as reducing global positioning uncertainty.

The proposed work consists of a 'one-way' experiment which can be considered as the evolution of a Michelson-Morley experiment. The experiment depends on super-stable lasers so it will advance that technology. In principle, the apparatus will be more sensitive than the Michelson interferometer by four orders of magnitude and will therefore greatly reduce global positioning uncertainty. Finally, the experiment is a physically distinct test of special relativity. The first order ether wind experiment utilizes light from two independent frequency stabilized lasers that coherently interferes to produce a time varying interference or difference frequency beat at the center of a rotating table. For uniform rotation in an ether wind, changes in the speed of light along the direction of propagation will result in time varying phase shifts in the interfered light and period shifts in the observed beat frequency.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, STABILITY, TRANSITION AND MIXING OF BOUNDARY LAYERS AND ADJACENT STREAMS

A.J. Laderman, Ford Aerospace & Communications Corp., *Ford Rd., Newport Beach, California* 92663 (DF040120; F44620-75-C-0016)

AF function - aerospace vehicles. Opportunity - defining and improving the performance of advanced weapons systems depends heavily on the increased understanding of the behavior of the flow fields influenced by the vehicle. Increased knowledge is needed on the transition to turbulence of the flow on systems such as reentry vehicles, heat shields and flowing gas lasers. Unexpected transition could adversely affect the ability to perform the mission. Objective -derive an analytic expression for the prediction of transition distance given in terms of the flow parameters for boundary layer, wakes and jets. How work contributes - provides design tools for the development of future aerospace systems.

Existing test data will be evaluated against the dissipation theory for transition. Equations for the prediction of transition for each type of flow will be formulated in terms of the time averaged flow parameters. The theory for the transition for boundary layers will be extended to include the effects of favorable pressure gradient and surface roughness. Additionally, the theory will be applied to free shear layers of dissimilar velocities, total temperature and specie composition - but without initial boundary conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, NAVY VEHICLE DESIGN AND CONSTRUCTION - NONLINEAR DYNAMIC SUBSTRUCTURING TECHNIQUES AND IDENTIFICATION OF COLLAPSE MECHANISMS

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The objective of this research is to develop efficient direct time integration strategies for large-scale non-linear dynamic analysis of Navy structures (ships, aircraft, submarines, missiles, etc.). The strategies require: an understanding of interactive characteristics of time integration methods with the attendant non-linearities in the system equations of motion; computer implementation of efficient error control and time-step changes; techniques to minimize computations per time-step and to maximize the time-step size within a permissible error allowance.

The three major attributes of a time integration package are the choice of integration algorithms, computer implementation, and error and step size control strategies. Algorithmic aspects affecting the efficiency of integration process have been investigated in the past two years under this contract. The effect of implementation can be assessed by a detailed examination of computational sequences which are taken at each integration step. Error and step size control strategies are based on the desired local accuracy of linear oscillatory components and on the rate of changes in nonlinearities. In addition, a hybrid (explicit-implicit) procedure is proposed to take advantage of both explicit and implicit schemes in one integration package.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0006, CALCULATION OF SEPARATED FLOW ABOUT A GENERAL BODY IN A NON-UNIFORM ONSET FLOW, 13690-EX

J.L. Hess, McDonnell Douglas Corp., *3855 Lakewood Blvd., Long Beach, California* 90808 (DA0E9040; DAAG29 76 C 0021)

To analyze the flow about a general three-dimensional body immersed in a non-uniform onset flow with the aim of predicting the aerodynamic pressures and forces acting on the body. The proposed investigation is directly relevant to the problems of missile separation on helicopters being studied at both MICOM and AMRDL-Eustis Directorate and is also relevant to the problem of gusts and round-to-round and launcher-to-round interferences on missiles.

Existing general surface singularity methods for calculating potential flow with uniform onset flow will be generalized to account for non-uniform onset flow conditions and possibilities of separated flow regions. Separated flow regions will be treated by either wake shape being input to calculation or having wake shape determined as part of an iterative computation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0007, THE EVALUATION OF TURBULENCE MODELS BY NUMERICAL SOLUTIONS OF THE NAVIER-STOKES EQUATIONS

J. Ferziger, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DN775080; N00014-77-C-0008)

The development of accurate models of turbulence is central to the formulation of reliable design methodologies for predicting viscous flow phenomena associated with aircraft, missiles and ships. The proposed research will utilize 'exact' solutions of the Navier-Stokes equations to assess commonly used turbulence closure models.

In the present research, the Navier-Stokes equations will be solved, numerically, by finite difference and spectral methods to provide numerical data with which turbulence closure models can be assessed. Initially, calculations by finite difference and by spectral methods will be compared for the case of homogeneous isotropic flow. Subsequently the spectral method will then be used to predict homogeneous nonisotropic (mean shear and strain) flows.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0008, NONLINEAR FLUTTER

S.C. McIntosh, Nielsen Engineering & Research Inc., *510 Clyde Ave., Mountain View, California* 94043 (DN890044; N00019-78-C-0118)

Investigate the influence of structural nonlinearities on the flutter of aerodynamic control surfaces.

A combined experimental/analytical study encompassing wind tunnel tests for simple aerodynamic sections which nonlinear torsional and plunging restraints together with theoretical predictions of limit cycle amplitudes and flutter speeds will be conducted. Correlations between calculated and measured results will be sought to identify the effectiveness and domains of applicability of the various analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0009, SURVEILLANCE - VIBRATIONAL RAMAN UV DOWN CONVERSION

E.A. Stappaerts, Northrop Corp., Research & Technology Center, *1 Research Park, Palos Verdes Peninsula, California* 90274 (DN875655; N00014-78-C-0832)

The objective of this work unit is to contribute to the development of a satellite mounted blue-green laser that is suitable for Navy communication and surveillance applications.

To accomplish the proposed objective, experiments and analyses are to be conducted to demonstrate efficient frequency down conversion of UV excimer laser output to the blue-green spectral region through the use of multiple order vibrational Raman scattering in a novel Raman oscillator/amplifier configuration. To maximize the speed of data acquisition the third harmonic of a high repetition rate Nd:YAG laser was used as a Raman pump during the initial, system optimization, phase of the program. The YAG laser has now been replaced by an E-beam XeCl excimer laser and during the extended time period provided by the no-funds extension, experiments will be carried out to demonstrate greater than 30% conversion efficiency into the blue-green.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0010, FLAT BUS FAULT SENSORS

E. Young, Rockwell International Corp., Autonetics Division, *3370 Miraloma Ave., Anaheim, California* 92803 (DN981064; N62269-78-C-0213)

To investigate and develop an electric power distribution fault sensing technique for use on the 270 volt DC two wire ungrounded power distribution system for operation in composite aircraft structures. This contract supports work unit ZA601, Agency Accession No. DN681080.

To study system hazards of lightning, EMP radiation and electric system faults to establish an operational philosophy for the 270 volt DC system for operation in composite aircraft structures. With this operational philosophy investigate and develop fault sensors for use on the electric power system utilizing flat bus electric power conductors.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0011, HIGH VOLTAGE DC GENERATOR SYSTEM

F. Echolds, Signal Co. Inc., Air Research Manfacturing Co. *2525 W. 190th St., Torrance, California* 90509 (DN781391; N62269-76-C-0223)

To develop a HVDC generator system incorporating design techniques for reduction of ripple voltage, transient surge voltage and rectifier commutation spikes. This contract supports work unit ZA601, Agency Accession No. DN681080.

To review exploratory development design techniques that have proven feasible and incorporate them in a total generator regulator system design.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0012, LOW LEAKAGE TURBINE SHAFT SEALS FOR ADVANCED COMBINED CYCLE SYSTEMS

G.W. Hosang, Solar Turbines International, *2200 Pacific Hwy., San Diego, California 92138* (DN890567; N00024-78-C-5345)

To develop a seals technology base that will reduce significantly the leakage rate currently experienced by steam turbines thereby reducing ship on-board maintenance and increase system reliability.

The general requirements for a highly efficient gas turbine waste heat recovery system indicate that a high speed (15,000 rpm) low leakage steam turbine is required. The following program will be implemented to achieve the low leakage aspect of this requirement: (a) Establish steam turbine seal design criteria. (b) Determine most critical application. (c) Design and fabricate candidate low leakage systems and seals. At least three candidates, two or more representing the latest state of the art from *vendors will be procured. (d) Establish experimental test facility* consistent with critical application and candidate seal configurations. (e) Conduct experimental tests including a 3000 hr. endurance test on the two most promising candidate seal configurations. Following evaluation of leakage rates and wear rates of *the candidate seal a recommendation will be made as to the* most promising low leakage seal for high speed steam turbine applications.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Sea Systems Command

4.0013, PATH INDEPENDENT INTEGRALS AND FRACTURE MECHANICS

G. Herrmann, Stanford University, School of Engineering, *Dept. of Mechanical Engineering, Stanford, California* 94305 (DF058200; AFOSR-80-0149)

AF function - aerospace vehicle structures. Opportunity - *path independent conservation integrals promise both fundamental* insight into the mechanical behavior of cracks, voids and other defects in structural materials, and a practical means for accurate engineering/design computations. Objective - to improve understanding of basic phenomena of fracture and failure, *and to improve computational methods for analysis and design.* How work contributes - develops and strengthens the mathematical and mechanical foundations upon which path independent integrals are built. Extends solid mechanics applicability to dynamic, nonlinear elastic and thermoelastic cases.

Begin by considering elastic continua, in both the material coordinate and the spatial coordinate description, allowing deformation gradients which are unsymmetrical as well as velocity *and time dependent. Develop the conservation-integral for these* continua from first principles, using deformation gradients rather than displacement gradients, for transparency in structure and meaning. Generalize, where possible and fruitful, to nonlinear elastic materials, and to thermoelastic and elastodynamic *problems.*

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of *Scientific Research*

4.0014, *STUDY OF COMPOUND SEMICONDUCTOR* SURFACES AND INTERFACES

W.E. Spicer, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DN575052; N00014-75-C-0289)

*New solid state electron devices for Navy electronic sys*tems continue to be affected by the conditions or properties of the solid surfaces and interfaces. Improvements in techniques to *minimize these surface effects will come about as an understand*ing develops of the role that clean surfaces and chemical effects of impurities have on electrical properties.

Based on the defect model for Fermi level pinning the surface of GaAs will be treated in situ by overpressures of arsenic *in an attempt to affect the surface electronic states.* Substrate temperatures will be monitored to search for effect of thermal activation on intermixing processes in the formation of Schottky barriers using gold. The effects of strain will be observed using XPS to look at valence band structure and the oxygen sticking coefficient. Various metal or oxygen depositions will be correlated with temperature variation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0015, A STUDY OF ENHANCEMENT OF VLF PROPAGATION BY CHEMICAL INJECTION

A.V. Darosa, Stanford University, Stanford Electronics Lab., Stanford, California 94305 (DN775706; N00014-77-C-0586)

The Navy relies on VLF waves for communication to submarines, and for navigation. The release of polyatomic chemicals into the ionosphere, whether intentional or unintentional *through rocket exhaust, can, by enhancing recombination, cause* depletion in plasma density to occur. The objective of this study is to determine the effects on VLF wave propagation, which may include enhancement of vlf plasmaspheric duct propagation, or disruption of waves propagating in the earth-ionosphere *waveguide.*

The propagation of VLF waves through theoretical simulations of ionospheric depletion is being investigated using ray-tracing and/or full wave analysis. Archived VLF signal recordings during satellite launches are being searched to identify possible perturbations caused by rocket exhaust. Active modification experiments are being planned for SPACELAB-2 over the conjugate point to the Siple VLF transmitter.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, DEVELOPMENT AND EVALUATION OF ADVANCED PARACHUTE DESIGNS

D. Reinhold, U.S. Dept. of Defense, Navy, Naval Weapons *Center, China Lake, California* 93555 (DN937028)

To improve consistency of parachute canopy operation, simplify manufacturing procedures, improve quality control, *reduce opening shock loads, reduce weight and bulk and im*prove operational envelope as a result of basic design capability. Goals: (a) a parachute canopy consisting of much less than the approx. 130 pieces in the present 28-ft. flat canopy; (b) reduction in operating forces by use of variable porosity and energy ab*sorbing materials; (c) maintain, as a minimum, the present capa*bilities; (d) reduce weight and bulk by 20%.

Bulk and weight to be reduced by use of wider fabric and new design and construction to reduce number of seams and reinforcing tapes. New materials to be used where same perform*ance can be obtained with weight and bulk savings. Energy ab*sorbers (peak load limiters) to be used to reduce strength requirements and therefore weight and bulk.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0017, STUDIES IN TRANSONIC FLOWS USING NUMERICAL METHODS

M. Holt, University of California, Berkeley Campus, School of *Engineering, Dept. of Mechanical Engineering, Berkeley, California* 94720 (DF044890; F49620-76-C-0006)

AF function - advanced aerospace vehicles and turbomachinery. Opportunity - improvement in present semi-numerical methods for solving viscous flow problems. Objective - develop *numerical techniques for treating both inviscid and viscous as*pects of transonic flows. How work contributes - improvement in capability to perform viscous flow calculations will improve design of airfoils and turbomachinery blades.

The finite element method of Glowinski and Pironneau will *be improved to achieve better accuracy in supersonic regions* and to include flows with shocks. To deal with coupled inviscid-viscous flows the technique developed by Holt and Chang for the highly yawed cone will be applied to the supercritical airfoil problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, ANALYSIS AND DESIGN OF FAULT TOLERANT COMPUTER SYSTEMS

J.P. Hayes, University of Southern California, School of Engineering, Dept. of Electrical Engineering, *3551 University Ave., Los Angeles, California* 90007 (DF049080; AFOSR-77-3352)

AF function - to promote the design and theory of fault tolerant computers, and their diagnosis and reconfiguration in a computer network. Deficiency - increasing demands are being placed on microprocessors and minicomputers for real time applications such as controlling the aerodynamic surfaces of an aircraft. There is an urgent need for methods for designing such systems so that if a fault occurs, the overall system will still operate satisfactorily. Objective - to develop better models and procedures for the recovery and configuration of a computer network when a fault has been diagnosed. How work contributes - the results of this research will be of great importance in designing future microprocessors which will satisfy the requirement for ultrareliable computing.

A graph model of computer network has been devised. This model has been shown to be valuable for the study of fault diagnosis. The work will be extended to achieve a larger model which can be used effectively to study the best ways to carry out the necessary reconfiguration and recovery after a fault is discovered. The properties of bit-sliced microprocessors will be investigated that relate to their reliability and fault tolerance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0019, INP TECHNOLOGY

G.A. Antypas, Varian Associates Inc., *611 Hansen Way, Palo Alto, California* 94303 (DF903360; F19628-77-C-0141)

Air Force function - communications. Deficiency or opportunity -the development of a device technology based on InP and InGaAsP quaternary alloys has enormous potential for integrated optics. This technology is in a primitive stage of development beset by a number of fundamental materials problems. Objective is to develop a materials and device technology based on InP and InGaAsP quaternary alloys for integrated optics systems. How research contributes - successful completion of this contractual effort would accomplish the following: 1) Provide a reliable process for the preparation of high quality polycrystalline InP source material for the growth of single crystals by the liquid encapsulation technique. 2) Determine optimum conditions for the LEC growth of high quality crystal InP. 3) Determine the conditions necessary to epitaxially deposit thin, uniform constant composition films of InP and InGaAsP.

Using a Bridgman technique, an investigation will be made to determine the optimum conditions of temperature and growth rate necessary to produce polycrystalline ingots of maximum size and minimum impurity content. The LEC growth of single crystal InP will be studied to determine the growth parameters necessary to eliminate twinning, minimize dislocations and grow high quality N plus, P plus and high resistivity InP. The epitaxial growth of InP and GaInAsP quaternary layers will be investigated both by supercooling and steady state techniques to determine the requisite conditions for the deposition of thin uniform films of constant composition. Pulsed plating of alternate layers of gold and zinc will be investigated to determine optimum conditions for producing low resistance ohmic contacts.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0020, MATERIAL SUPPORT TECHNOLOGY - HIGH FIELD ELECTRON TRANSPORT IN SEMICONDUCTORS

D.K. Ferry, Colorado State University, School of Engineering, Dept. of Electrical Engineering, *Fort Collins, Colorado* 80523 (DN075033; N00014-78-C-0124)

High field transport of electrons at surfaces and in structures of submicron dimensions must be studied to support developments in new electronic materials and devices for future Navy electronics systems.

Theoretical and experimental studies will continue on the problems of electron transport in quantized inversion layers formed at silicon-silicon dioxide interfaces and at the indium arsenide-insulator interface. Theory will be developed for consideration of various proposed scattering mechanisms and coordinated with the experimental measurements and characterization. Characterization techniques include Hall measurements and x-ray photoemission spectroscopy. Theoretical studies will be made on transport in submicron scale devices in high electric fields. Consideration will be given to field inhomogeneities, dielectric response, effects on device characteristics, and possible synergetic device-device interactions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, AN ANALYTIC ARTIFICAL SATELLITE THEORY

K.T. Alfriend, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680001)

The long range objective is to develop an accurate analytic artificial satellite theory. The immediate objective is to develop a partial analytic theory using Vinti's theory as an initial approximation in order to evaluate the feasibility of this approach for the development of a full analytic theory. Such as theory could substantially reduce the costs incurred in the orbit prediction and determination of military satellites.

A partial analytic theory which uses Vinti's solution as the initial approximation and which includes some of the zonal and tesseral harmonics, and lunar and solar perturbations will be developed. This theory will then be compared with other theories to determine the best approach for developing a complete analytic theory. The complete analytic theory will then be developed. To develop the theory, the initial approximation will be expressed in a suitable set of canonical variables. The perturbing potential will then be expressed in this set of variables and the method of LIE series will then be used to develop a solution. All algebraic manipulation will be performed on the computer using algebraic manipulation routines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0022, OPTICAL MICROCIRCUITRY

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(a) To investigate acousto-optic and electrooptic processes in optical waveguides; (b) to utilize these effects to fabricate optical circuits for use as terminals; (c) to develop signal processors using integrated optical technology; (d) to investigate possible thin film-optical fiber couplers; (e) to determine the causes of thin film light scattering and to investigate dielectric waveguide formation. The Navy has a continuing need for optical devices and systems with emphasis on efficiency, size, weight and versatility. These characteristics are features of microoptics.

(a) Using sputtering and indiffusion techniques, study the formation of optical waveguide and construct waveguide structures such as channel waveguide couplers, overlay interconnects and modal liftoff stuctures; (b) demonstrate active waveguide devices in indiffused ferroelectrics and on silicon substrates; (c) with surface acoustic waves, study acousto-optic interactions spectrum analysis and fabricate optical methods of tapping acoustic signal processors; (d) study polarization characteristics of light transmitted in fibers and integrated optical device performance when two polarizations are present.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0023, DEEP IMPURITIES IN GAAS AND INP

J.J. Krebs, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680309)

The ultimate aim of the present study is to acquire a sufficiently clear microscopic understanding of the nature and behavior of Cr and other electronically important deep centers in Cr-doped GaAs and InP that the properties of this semi-insulating material can be controlled in a rational and reproducible manner for microwave device use.

A systematic study of semi-insulating GaAs Cr will be carried out relying mainly on two techniques - electron paramagne-

tic resonance (EPR) and photoluminescence (PL) - including PL excitation and quenching spectroscopy. Materials for these studies will be obtained from both in-house and external sources and will also be characterized chemically and electrically. Similar studies on Fe-doped InP are also planned.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0024, DELTA-K RADAR DEVELOPMENT PROGRAM
D.L. Schuler, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN480224)

The purpose of this research project is to determine the effectiveness of a coherent dual-frequency correlation radar for achieving (a) target classification, and (b) remote sensing of ocean waves and surface currents.

The delta-K radar transmits two closely-spaced RF frequencies and, upon reception, cross-correlates the coherently detected backscattered EM fields to achieve an output which has many of the characteristics of HF return from ships and the sea. Target classification is implemented through swept-frequency measurement of target resonances which occur at the difference frequency. Sea spectra and ocean surface currents are remotely sensed by this system.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0025, ELECTRICALLY-EXCITED LASERS
W.S. Watt, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN620092)

The Department of Defense has need for efficient, compact laser sources for applications such as communications, ranging, detection and navigation. Electrical excitation is projected to preferentially populate excited states in atoms and molecules and hence to provide the population inversions necessary for laser development.

Electron-beam, electron-beam sustained and other electric-discharge techniques are being investigated for CW and pulsed laser source development. The physics of electron and ion collisions are studied to understand the underlying atomic and molecular excitation processes. The use of gasdynamic techniques to create or increase population inversions is studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0026, REMOTE SENSING INSTRUMENTATION FOR GAS TURBINE ENGINES (NITRIC OXIDE)
N. Krull, U.S. Dept. of Transportation, Federal Aviation Admin., *800 Independence Ave. S.W., Washington, District of Columbia* 20590 (DN796816)

Document and explain the differences between the optical and sample extraction techniques for the measurement of nitric oxide in aircraft engine exhaust plumes.

Conduct a series of well controlled experiments, using a series of combustion sources of nitric oxide with increasing complexity. Compare levels of nitric oxide as determined by UV and IR spectrometer and standard probe extraction methods.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

4.0027, DIGITAL ELECTRONIC CONTROL SYSTEM RELIABILITY (FULL-AUTHORITY, FAULT-TOLERANT EEC)
M. McGlone, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF464440; F33615-79-C-2082)

This is a dual award contract to evolve design guidance with respect to one facet of the reliability/availability/integrity issue associated with the future development of digital electronic engine control systems - that of providing for very high reliability through the use of redundancy/fault-tolerance, tailored to the needs of variable cycle engine control and optimized with respect to the reliability of the system (and of its components) and to cost-of-ownership.

Employ the services of two contractors - one skilled in the synthesis of very high-reliability, fault-tolerant digital computer systems, and the other skilled in the synthesis of control systems for the engine of high-performance military combat aircraft. Require that they work together closely in a program of study and analysis to produce design guidance needed for the future development of full-authority, fault-tolerant (digital) electronic engine control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0028, ROCKET RESEARCH AT GEORGIA TECH
J. Hubbartt, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (DF050310; F49620-78-C-0003)

AF function - the Air Force has a continuing need for weapons systems which rely on improved rocket propulsion. Deficiency - current rocket propulsive concepts have encountered difficulty with combustion instability, nozzle erosion and loss of thrust efficiency by base drag and two phase flow sources. Objective - this work will continue the efforts which were initiated under AFOSR grants 73-2571, 75-2984, 75-2805 and 76-2912. The first portion will improve methods of measuring the response functions of solid rocket propellants. The second will evaluate the feasibility of external burning techniques in rockets and missiles. The third will specify the mechanisms of aluminum combustion in rocket propellants. And the fourth will determine the mechanisms of rocket chamber pressure fluctuations which emanate from turbulent reactions with the motor nozzle. How work contributes - each of the individual tasks will improve our capabilities to produce rocket propulsion systems with improved performance at a reduced cost.

The first task will improve data acquisition techniques in impedance tube devices. It will also apply these improved techniques to more conventional t-burner devices. Gas phase acoustic losses in burner tubes will be accounted for. The possibility of using the driven burner technique to measure velocity-coupled response factors will also be investigated. In the second task, which deals with external burning, hydrogen-air burning tests will be performed in a Mach 3 tunnel. Emphasis will be placed on obtaining convincing evidence that the results are free of tunnel interference effects. The experiment will then be modified to investigate thoroughly the effects of simultaneous external and base burning. In the third task, which deals with aluminum combustion, response of binders, of aluminum particles, of aluminum powders, of binder-aluminum mixtures, etc., are observed during and after heating to desired temperatures in controlled atmospheres. Observations are made by microscope viewing during heating and scanning electron microscopy after interruption of heating, or quenching of combustion by several techniques. In the fourth task a new, untested mechanism for the cause of interior rocket motor pressure fluctuations will be investigated. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0029, DEVELOP AND PROTOTYPE A FATIGUE MONITORING SYSTEM FOR THE F-14A AIRCRAFT
R. Mellyn, General Time Corp., Electronics Division, *1200 Hicks Rd., Rolling Meadows, Illinois* 60008 (DN890137; N00019-79-C-0054)

To provide data from each aircraft that will permit the tracking of fatigue life usage, and crack growth to a level not previously obtainable.

The contractor will take advantage of the latest state of the art, while maintaining a low risk approach to arrive at a system that is close to optimum operationally. The design of the individual modules and/or sections will be capable of superior performance while operating in the sometimes severe airborne environments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0030, GRAPH THEORY AND COMBINATORICS WITH APPLICATIONS TO DIGITAL SYSTEMS AND NETWORKS

S.L. Hakimi, Northwestern University, Evanston Campus, Technological Inst., Dept. of Electrical Engineering, *633 Clark St., Evanston, Illinois* 60201 (DF043670; AFOSR-76-3017)

AF function - the design of complex networks, such as in electrical transportation, and communications systems. Deficiency - the knottiest problems in this field are combinatorial, and existing methods are relatively few and they do not form a unified theory. Objective - the objective of this research is to develop analysis and design methods that will be useful in solving the various types of network problems. How work contributes - success in this research could lead to significantly better logistics and communications systems in the Air Force.

The main tool will be the theory of graphs, a fairly new field with few experts, but which has surprisingly many applications to sundry and disparate concrete problems. Emphasis will be placed in the areas of invulnerable communications networks, the construction of codes exhibiting high degrees of automatic error detection or error correcting capability, and digital systems and their fault diagnosis and correction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, STUDIES OF EQUATORIAL GHZ SCINTILLATION PROBLEMS 14260-ELX

K.C. Yeh, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DA0E9192; DAAG29-78-G-0101)

To study experimentally and theoretically equatorial scintillation of transionospheric radio signals. Relevance - this study will address the problem of signal fading in the DOD-wide navigation (global positioning system) and communication systems. For optimum signal design and failure analysis, signal fadings have to be known at location of maximum occurrence (equator).

Emphasis will be placed on gHz scintillations and their relations to scintillations at lower frequencies. Experiments with ATS-O6 and other geostationary satellites are proposed to study multifrequency dependence, multiple scattering effects and climatology of scintillations. Experimental data will be compared with model computations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0032, F101 CENTRAL INTEGRATED TEST SUBSYSTEM EVALUATION

Unknown, General Electric Co., *7735 Old Georgetown Rd., Bethesda, Maryland* 20014 (DF463660; F33615-79-C-2022)

To evaluate the effectiveness of a state-of-the-art turbine engine monitoring system.

4400 hours of engine flight data will be correlated with monitoring system output and maintenance actions. Results will be used to provide an indication of system effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0033, ADVANCED STRAIN GAUGE PRESSURE TRANSDUCER

Unknown, Gould Inc., Chesapeake Institute Division, *6711 Bay Meadow Dr., Glen Burnie, Maryland* 21061 (DF463040; F33615-78-C-2064)

To test and evaluate the impact of an improved strain gauge deposition process and lead-wire attachment technique on the operation of strain gauge pressure transducers used in gas turbine engine control and diagnostic systems.

Three phases - (1) bench test new strain gauge approach to validate operation and durability, (2) implement in a pressure transducer and evaluate performance, (3) piggyback engine test transducers to judge operational suitability.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0034, NONLINEAR INTERACTIONS BETWEEN LASER RADIATION AND SPIN ALIGNED CARRIERS IN SEMICONDUCTORS

E.J. Johnson, General Telephone & Electronics Corp., G T E Laboratories Inc, *40 Sylvan Rd., Waltham, Massachusetts* 02154 (DF052630; F49620-78-C-0082)

AF function - secure space communication and covert optical electronics require devices which exploit the properties and interaction effects of materials with infrared radiation. Opportunity - infrared materials research has a high potential impact on novel detectors, sources and communications for airborne and spaceborne applications. Objective - there are five principal objectives in this research on semiconducting compounds: 1) to better understand details of the spin dynamics of recombining electron-hole pairs, 2) to study the spin dependence of optical transitions near the fundamental absorption edge, 3) determine the gain and polarization properties of lasers in the presence of spin alignment, 4) study the effects of optical spin alignment on the output of laser amplifiers using polarized injection signals, 5) investigate techniques for fast switching of the polarization of infrared signals using spin-dependent phenomena. How work contributes - it is expected that this work will lead to a powerful technique for fundamental studies of semiconductors for fine probing of spin-dependent optical transitions, for studying spin dynamics in the formation of various band-edge complexes and for influencing stimulated emission processes. Optical spin alignment has far-reaching implications for the technology of semiconductor lasers as infrared sources and signal processing devices that are needed for optical communications.

The general approach will be to examine the intensity and analyze the polarization of emitted radiation in photoluminescent experiments under a variety of conditions. In simple preliminary optical spin alignment (OSA) experiments, a bulk sample will be used and the exciting radiation of arbitrary frequency will be circularly polarized. In experiments designed for detailed probing of the fundamental absorption edge, the high intensity tunable output of an infrared dye laser pumped with a cavity dumped krypton ion laser will be used as the source of exciting light. To study effects of spin alignment on stimulated emission, resonator structures are being developed for oscillator and amplifier applications. Using such resonators, the effect of polarized pumping and polarized injection signals on the intensity and polarization of the output emission will be studied. Techniques for fast switching of laser output will evolve from the study of OSA interactions in stimulated emission. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0035, CLOUD/ICING/VISIBILITY ANALYSIS SYSTEM (CIVAS)

W.D. Mount, Geo Atmospherics Corp., *P.O. Box 177, Lincoln, Massachusetts* 01773 (DA0F2203; DAAD07-79-C-0089)

To provide Army aviators with an automated procedure for estimating the current threat of icing conditions on a scale of 5 km.

Existing computer programs for analyzing cloud and visibility conditions from standard airways and synoptic observations will be modified to add temperature/icing - and reduce the grid size of 5 km.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

4.0036, FUNDAMENTAL GROWTH STUDIES INP

Unknown, Massachusetts Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF905980)

Air Force function - integrated optics for communications systems. Deficiency - the development of a device technology based on InP has great potential for integrated optics systems. This technology is in a formative stage of development beset by a number of fundamental substrate problems. Objective - to investigate and develop cost-effective techniques for the synthesis and growth of high quality single crystal InP. How research contributes - research is designed to accomplish the following:

1) determine the necessary conditions to obtain reproducible high purity polycrystalline ingots of inp as indicated by their electrical properties; 2) to determine the necessary LEC conditions to obtain a high yield of twin-free, low dislocation crystals either of high purity if undoped, or with uniform impurity concentration, if intentionally doped.

To develop an improved Bridgman synthesis technique alternative sources of In and P starting materials alternative boat materials such as SiO2 pyrolysis and AIN will be investigated. Operating parameters such as P temperature, furnace profile, interface shape and crystallization rate will be optimized. To develop as improved technique from LEC growth variables such as crucible material, pretreatment of B2O3, seed quality and orientation, chemical composition and pressure of ambient gas, temperature gradients, boule size and shape and pulling and rotation rates will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0037, THE INFLUENCE OF SOUND UPON BOUNDARY LAYER TRANSITION

P. Leehey, Massachusetts Inst. of Technology, School of Engineering, Dept. of Ocean Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN675214; N00014-76-C-0396)

This task contributes to the solution of the problem of designing hydrodynamically efficient vehicles and control surface configurations. Specifically, the task will determine the effect of sound on a laminar boundary layer and its transition to turbulent boundary layers.

Experimental and theoretical studies will be made of the three principal active means for exciting a laminar boundary layer to transition, namely; sound, stream turbulence and vibration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, STUDIES RELEVANT TO THE INTERACTION OF SPACECRAFT WITH PLASMA

J.W. Cipolla, Northeastern University, School of Engineering, Dept. of Mechanical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF053690; AFOSR-78-3731)

AF function - AF communication and surveillance satellites have been affected deleteriously by interaction with energetic charged particles in the space environment. Environmentally induced arc-discharges can cause loss of satellite command and telemetry communications and disrupt entire missions. Deficiency - anomalous behavior can occur in synchronous orbit satellites and satellites in lower orbits. The charging of the spacecraft by energetic electrons in the magnetosphere can produce large negative differential potentials and damaging discharges. Objective - develop a mathematical model of the time dependent spacecraft-plasma interaction, and study low frequency instabilities and shock wave structure which can generate energetic electron clouds in the geosynchronous plasma in excess of those associated with magnetospheric substorms. Contribution - provide a more complete understanding of the plasma environment at geosynchronous orbit and of the dynamic interaction of solid bodies and space plasmas.

(1) Spacecraft charging - a plane slab immersed in a neutral plasma is assumed to absorb all incident charge at some initial time. The model includes the dynamics of the resulting plasma sheath development, the propagation of ion acoustic waves into the plasma, the subsequent approach to the steady floating potential on the body and steady ion rarefaction wave connecting the wall potential to the undisturbed plasma. Ion temperature and electron inertial effects are neglected. (2) Shock wave propagation - the role of low frequency streaming instabilities on collisionless shock wave structure is extended to include the effects of oblique propagation on shock waves parallel to the ambient magnetic field and of ion reflection from the potential barrier of an ion acoustic subshock in a high Mach number parallel shock wave.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, SIMPLIFIED INERTIAL GUIDANCE DEMONSTRATION (SIG-D)

J.P. Laughlin, Vought Corp., Michigan Division, *P.O. Box 909, Sterling Heights, Michigan* 48077 (DA0F1235; DAAK40 76 C 0669)

The technical objective is to design, manufacture, test and deliver three flight demonstration missile airframes with pneumatic controls to be utilized as flight demonstration vehicles to test low cost strapdown guidance techniques.

The airframe will use solid propellant motors manufactured during the Greener Pastures program, empty Lance E-11 warheads for the nose section, and modified midsection for guidance system mounting. Aft mounted pneumatic controls using four elevons for control will be developed. Midship wings and aft tail/elevon surfaces are being designed based on wind tunnel tests. The government will integrate a ring laser gyro strapdown inertial guidance system into the airframe for feasibility demonstration flight testing.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Guidance & Control Directorate

4.0040, IMPURITY AND DEFECT BEHAVIOR IN HIGH PURITY EPITAXIAL GAAS

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF042510; AFOSR-76-2950)

AF function - microwave solid state electronic devices are essential components of Air Force surveillance, electronic countermeasures and communications systems. Devices made from gallium arsenide show great promise for improved performance and reliability in the microwave region. Deficiency - doping and uniformity of doping in GaAs are generally believed to be major contributing factors in the high cost, low yield and poor reliability of present-day GaAs devices. Objective - it is the objective of this work to obtain a better understanding of the impurities and defects in GaAs epitaxial layers. How work contributes - this work will pursue the objective by looking at residual impurities, dopants and native defects in high purity epitaxial GaAs, and in this way the research will lead to more reproducible, uniformly doped material resulting in lower cost, improved devices.

Recent results have indicated that the problems occurring at the substrate/epitaxial interface (i.e., low resistance region at the epitaxial/semi-insulating substrate interface or high resistance region at the epitaxial/heavily-doped substrate interface) are caused by the manner in which the residual or intentionally-added dopants are incorporated into the epitaxial layer near the substrate. In order to clarify these early indications, growth and doping experiments will be carried out with different substrates and dopants and with detailed impurity profile measurements in order to verify the preliminary theories and to investigate possible means of avoiding these interfacial regions. Work will continue on the annealing experiments on undoped and doped samples in order to obtain a better understanding of the self-compensation effect in GaAs. Research will also continue in the general area of understanding intentionally-added impurities and stoichiometric defects in GaAs, including a determination of the interaction between various impurities and defects and a study of the manner in which impurities and defects are incorporated into the growing epitaxial layer. This research will include the growth of a large number of epitaxial layers under varying conditions (different dopants, substrates and growth rates) by vapor phase epitaxy. Differential capacitance, resistivity, Hall and photoluminescence measurements will be made to determine the total impurity, defect or complex donor concentrations, the impurity profile and the identification of different species.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0041, II-IV-V2 CHALCOPYRITES FOR HIGH-SPEED DEVICES

C.M. Wolfe, Washington University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF054860; AFOSR-79-0096)

AF function - microwave solid state electronic devices are essential components of Air Force reconnaissance, electronic

countermeasures and communications systems. Opportunity - Air Force systems needs continue to demand improvements in frequency, power, bandwidth, noise performance and efficiency in solid state electronic devices. Currently GaAs, InP, and III-V ternary and quaternary alloys of various composition are being investigated because of their high electron mobility, high saturated velocity and transferred electron effects. The II-IV-V2 chalcopyrites offer similar parameters but without the disadvantages of low thermal conductivity and other effects caused by random alloy scattering. Objective - to develop suitable growth techniques for ZnGeAs2 on GaAs or Ge, CdSnP2 on InP, and determine the suitability of these materials for application in high speed devices. How work contributes - successful completion of this effort could lead to new or improved types of microwave device materials.

Epitaxial layers of CdSnP2 will be grown on InP substrates in a liquid-phase epitaxial system using elemental Cd and P as initial sources in a Sn solution. Variations in melt temperature, melt composition, and cool-down rate will be accomplished to obtain good quality epilayers. Epitaxial layers of ZnGeAs2 will be grown on GaAs or Ge substrates in a vapor phase system using elemental Zn and Ge, and AsCl3 as a source of As and Cl to transport the Ge. Variations in source and substrate temperatures and flow rates will be made to obtain good quality epilayers. Investigation of intentionally added dopants will be performed in both types of materials. Other technologies including that for forming ohmic contacts and Schottky barriers, and the development of etchants for the delineation of interfaces and defects will also need to be developed so that the resulting layers can be characterized.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0042, SECOND-ORDER CLOSURE MODELING OF TURBULENT COMBUSTION

A.K. Varma, Aeronautical Research Associates of Princeton Inc., *50 Washington Rd., Princeton, New Jersey* 08540 (DN975373; N00014-79-C-0335)

The objective of this study is to develop a computation procedure for determining turbulent reacting flows in realistic geometries. This information is needed both for a better understanding of the complex flow-field within the combustors of aircraft turbojet engines and to provide a basis for advanced combustor design. Ultimately it should lead to improved propulsion systems for naval weaponry applications.

An evaluation will be made of a previously developed three species joint probability density function for modeling scalar correlations in an exact time-averaged formulation of turbulent reacting flows. These correlations will be used in a complete second-order closure analysis for simple parabolic axisymmetric and planar configurations. The results will be compared with available experimental measurements and will be studied to identify the most important interactions of the turbulence and combustion.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0043, NAVY VEHICLE DESIGN AND CONSTRUCTION - FLUTTER OF AXIAL-TURBOMACHINE BLADING

F.A. Sisto, Stevens Inst. of Technology, School of Engineering, Dept. of Mechanical Engineering, *Castle Point Station, Hoboken, New Jersey* 07030 (DN923286; N00014-76-C-0540)

This research covers theoretical analysis and experimental measurements of self-excited and forced vibration aspects of typical gas turbine compressor blading. Such vibration, 'blade flutter', leads to gross mechanical behavior problems and to failure in meeting full design requirements for aircraft jet engines. Hence, this research contributes to assuring optimum jet engine performance at maximum rated power, and hopefully to increased life and reliability of military engines.

The investigation aims at acquisition of accurate experimental blade flutter data from annular cascade rigs incorporating suitable test sections, blowing equipment and variable guide vanes and blading. The many geometric, aerodynamic, vibratory parameters affecting nonstationary aerodynamic lift and moment coefficients are considered. A rotor rig is nearing completion which will have greater accuracy (vs a strator rig) in procurement of aeroelastic data.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0044, DYNAMIC ENGINE SIMULATOR

S. Mersky, U.S. Dept. of Defense, Navy, Naval Air Engineering Center, *Lakehurst, New Jersey* 08733 (DN096111)

Design and develop a working model of a dynamic engine simulator, utilizing state-of-the-art technology, which will fully simulate the actual start-up and sustained operation of a turbojet/fan engine.

The full measurement and testing capabilities of all turbojet/fan engine test systems presently in use or in production must be identified. Also, testing requirements and parameter relationships of a sample jet engine must also be identified. A mathematical model of a jet engine must be developed and a working model of a dynamic engine simulator must be designed, develop and constructed. Additional software will be developed for other engines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0045, PORTABLE CEILING AND VISIBILITY SENSOR (VISIOCEILOMETER)

R.S. Bonner, U.S. Dept. of Defense, Army, Electronics Research & Development Command, Atmospheric Sensing Div., *White Sands M.R., Las Cruces, New Mexico* 88002 (DA0D2293)

To provide a hand portable ceiling and visibility sensor to support Army aircraft and artillery operations in forward areas.

Develop first experimental prototype (XE-1) visioceilometer, evaluate it, and identify problem areas for enhancement. Design and develop second experimental prototype (XE-2) visioceilometer. Obtain LOA from interested user.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

4.0046, ANALYSIS OF THE NOAA ALASKAN MST RADAR SYSTEM DATA

M.C. Kelley, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (DF057470; AFOSR-80-0020)

AF function - satellite ephermeris and missile trajectory predictions, missile plume and nuclear effects modeling, ionospheric modeling in support of OTH-B and communications and analyses of the effects of AF operations on the stratosphere are all impacted upon by the dynamics of the region between the earth's surface and 100 km altitude. Deficiency/opportunity - no capability exists for continuous high time resolution measurements of the winds and turbulence throughout this region. Studies by the NOAA Aeronomy Laboratory have shown that a 50 mHz radar with sufficient aperture/power should find sufficient refractive index gradients to provide sufficient backscatter throughout the region. Under NSF, and some OSR support, NOAA is constructing a radar near Poker Flats, Alaska. A quarter of the dipole array has been providing initial measurements since early spring 1979. The full array should be operating by the fall of 1979. The opportunity exists therefore to assist in the generation of a research using a new and unique research tool. How work contributes - theoretical studies of middle atmospheric tides and gravity waves driving the ionosphere are in need of corroborating data. Diffusion studies in the stratosphere and wave/wave coupling studies also require fine scale measurements of the dynamics. The MST radar will provide these measurements.

This work effort will couple a strong research team in radar studies at Cornell University with the Alaskan radar. It will also add a meteorolorist to the research teams. The Cornell group will assist in establishing research goals, measurement methodology, data analysis and interpretation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0047, AN ANALYSIS OF AN INVENTORY SYSTEM FOR INTERCHANGEABLE RECOVERING ITEMS

J.A. Muckstadt, Cornell University, Ithaca Campus, School of Engineering, Dept. of Operations Research, *242 Carpenter Hall, Ithaca, New York* 14853 (DF051740; AFOSR-78-3568)

AF function - to repair and maintain complex equipment in aerospace vehicles and ground installations, and to develop better methods in inventory control to expedite the performance of the required maintenance. Deficiency - in many situations, a faulty component can be replaced by any of several types of parts, with some parts being more sophisticated or versatile than others because of possible demands in other more complicated systems than the one under repair. How many of the various types to stock, and which of several kinds to use when replacement is possible entails decisions for which there is no satisfactory basis at this time. Objective - to develop analytic tools that will aid in the study of this problem area. How work contributes -success in this research could lead to significantly smaller inventory costs or fewer backorders, with a smaller proportion of inoperable machines.

The two echelon supply system will be somewhat simplified to get an efficient model, and a number of intuitively near-optimal substitution rules will be evaluated. Analytic procedures will be used where possible, exploiting good approximations to the extent possible. computation simulations will be used where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0048, ONE HORSEPOWER MOTOR

J. Pinner, I M C Magnetics Corp., *570 Main St., Westbury, New York* 11591 (DN881391; N62269-78-C-0397)

To develop motors applicable to the 270 volts DC power system under development for future naval aircraft. This contract supports work unit ZA601, Agency Accession No. DN681080.

To investigate the use of newly developed high energy product samarium cobalt permanent magnets for DC brushless motor designs to achieve desired motor performance characteristics and size and weight comparability with present AC motor designs.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

4.0049, MULTICS REMOTE DATA ENTRY

J. Cupak, Pattern Analysis Recognition Corp., *310 E. Chestnut St., Rome, New York* 13440 (DF728900; F30602-77-C-0174)

The objective of this effort is to develop the capability for remote data entry into MULTICS OLPARS. OLPARS is an interactive graphics oriented system to aid in classification logic design and is available to remote users via access over the ARPA net.

An in-house analysis will be made to determine what hardware and software is needed to allow a user to enter data into the OLPARS filing system remotely. Cost factors, as well as ease of data entry, will be considered in determining what hardware will be used. The hardware and software will be implemented and then tested via the RADC ARPA net tip.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0050, INTERACTIONS OF ELECTROMAGNETIC FIELDS AND PLASMA BEAMS

B.R. Cheo, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Electrical Engineering, *333 Jay St., Brooklyn, New York* 11201 (DF038340; AFOSR-79-0009)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, space and ionospheric communications as well as countermeasures demand the fundamental understanding of interactions of electromagnetic fields and plasma beams. Deficiency - the aforementioned information required for the design of advanced equipment is not available today. Its acquisition may be realized by a well planned theoretical and experimental research program. Objective - this program will study the mechanisms of a self-sustaining plasma beam as a guiding structure for high power electromagnetic fields at microwave frequencies. Contribution - this work is a part of a comprehensive program of plasma research for the development of an x-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and particle beams), the development of space and ionospheric communications, and the development of countermeasures.

This project will investigate both theoretically and experimentally (a) The interaction of a high power microwave radiation with a plasma beam. Specifically (1) the correlation measurement between the phase of the microwave and that of the electrostatic ion cyclotron oscillation. This requires a phase locked local oscillator to downbeat the x-band signal; (2) the formation and maintenance of the beam is believed to be the result of the balance between the ionization produced by the microwave and the enhanced transverse diffusion due to the nearly coherent oscillation of the electrostatic ion cyclotron wave. A theory was formulated to calculate this enhanced diffusion constant, more experimental results are needed for its verification. (b) The imploding tube experiments, which are expected to obtain high plasma densities and temperatures by combining a classical plasma pinch with inertial confinement produced by imploding a metallic plasma tube. The theoretical work will use the three conservation equations (mass, momentum, and energy) in cylindrical coordinates and is expected to use the method of characteristics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0051, ANALYSIS OF LUBRICANT FILMS IN BEARINGS UNDER INCIPIENT FAILURE CONDITIONS

J.L. Lauer, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Mechanical Engin Aeronautical Engin & Mechanics, *110 8th St., Troy, New York* 12181 (DF051060; AFOSR-78-3473)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - lubricants continue to fail at elevated temperatures due to complex chemical and physical interactions of the bulk lubricant with its environment and with both static and moving metal surfaces. Objective - understand the bulk and boundary layer chemical-physical properties of lubricants to determine causes of bearing failure. How work contributes - information gained from this research will be used to formulate improved lubricants for AF application that can withstand conditions of extremely high temperatures, pressures and shear rates.

Infrared emission spectra will be obtained through a window in an operating sliding bearing lubricated by a number of standard fluids. A variety of realistic operating conditions will be probed. The spectra will be analyzed for chemical and physical changes in the fluids (e.g. decompositions, glass transitions), fluid film and metal surface temperatures, and molecular alignment by polarization techniques. Conditions leading to bearing failure will be probed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0052, INTRASYSTEM EMC SUSCEPTIBILITY

D. Weiner, Syracuse University, L.C. Smith College of Engineering, Dept. of Electrical & Computer Engineering, *Link Hall, Syracuse, New York* 13210 (DF930410; F30602-78-C-0083)

The objective of this effort, entitled intrasystem electromagnetic compatibility susceptibility study, is to examine the electromagnetic interference (EMI) behavior of devices such as fuel gauge indicators, electroexplosive devices, logic circuits, display units, etc.

The approach will be then to determine EMI performance curves for such devices. These performance curves will relate device degradation to various interference signal parameters.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0053, IN HOUSE MEASUREMENTS PROGRAM
D.W. Hanson, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF740510)

Air Force function - this effort supports research to improve the space object characterization and mission assessment capability of the USAF. Deficiency - high resolution imagery of space objects cannot be obtained from ground based sensors, due to optical phase aberrations caused by turbulence in the earth's atmosphere. Mission assessment and identification of spacecraft must therefore depend on other than high resolution imagery. Objective - to measure atmospheric and optical propagation parameters. How research contributes - the data obtained will be used to verify existing theoretical analyses and to provide design parameters for compensated imaging systems.

Theoretical considerations will be used to establish a priority on parameters to be measured. Existing scientific packages at the Verona test site will be used to make the required measurements. The coelostat and one meter telescope gives the verona facility the capability of extremely accurate positioning, limited tracking, and making both up and down path measurements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0054, INFLUENCE OF STOICHIOMETRY ON THE IMPINGEMENT EROSION OF LEAD SULFIDE AND ZINC SULFIDE
R.G. Hoagland, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DF048220; AFOSR-77-3283)

AF function - aircraft and missile operations are highly dependent on electromagnetic windows necessary for the transmission and reception of signals for navigation, target acquisition, target designation and communications. Deficiency - the vehicles must perform at high velocity in adverse weather where rain erosion of the exposed window is a serious problem. Objective - the objective of this work unit is to study the influence of stoichiometry on the rain erosion of ceramic windows. How work contributes - decreasing the surface erosion on windows will significantly improve the accuracy, sensitivity, and detectability of the electrooptical systems.

The approach is to investigate in detail the specific mechanisms of surface layer deformation produced by high velocity liquid droplets for several binary alloys whose mechanical properties can be systematically varied through control of compound stoichiometry. Materials to be studied include PbS, ZnSe, and ZnS. Liquid drops of silicone oils and mercury will impact the samples at a relative speed up to 680 m/sec (Mach 2).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0055, OPTICAL WAVEGUIDE SPATIAL FILTERS
D.W. Vahey, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF054470; F49620-79-C-0044)

AF function - advanced Air Force weapon systems require the real time processing of data obtained from a multitude of sensors at data rates which exceed current capabilities. This requirement necessitates the development of analog parallel processing techniques such as optical or acousto-optical processing. Opportunity - an integrated optical format must be found before such processing can be realizable onboard aircraft and missiles. Objective - this research will investigate programmable spatial filters integrated into an optical waveguide. Such filters would be ideally suited to performing real time signal correlations. How work contributes - the effort advances optical processors for command and control systems, especially for signal acquisition.

The initial effort will investigate nonprogrammable spatial filtering employing such techniques as waveguide overlays and deflecting waveguide gratings. Both the spatial filter and the acoustic wave will occupy a lithium niobate waveguide. Designs judged to be suitable for programmable spatial filtering, including designs based on electrooptic mode converters and prisms, will be theoretically modeled to accurately predict their performance characteristics. Fabrication of a single programmable switch will be undertaken, followed by the implementation of a number of switches in a spatial filter array. The performance of the programmable spatial filter so constructed will be evaluated by acoustooptic correlation of coded signal and reference waveforms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0056, COMPRESSOR/TURBINE INSTRUMENTATION AND TRANSIENT ANALYSIS EQUIPMENT
D.L. McCormick, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451960)

To purchase high response instrumentation and data acquisition and handling equipment for use in the in-house test programs.

Determine future instrumentation needs of turbine engine research testing. Purchase the most compatible equipment, design an operable system, supervise installation in Room 17 and 21, and prepare operating instruction handbook. Conduct detailed performance tests of critical subsystems as installed and prepare AFAPL TR based on results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0057, CRF/J85 TRANSIENT INVESTIGATION
F. Ostdiek, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460550)

The primary objectives of this program are to determine the effects of speed transients on compressor performance, to obtain detailed information on compressor operating paths during transient operation, and to investigate the cause of compressor performance differences between transient and steady-state operation. This information will primarily be used to evaluate transient compressor test techniques for application to APL's CRF.

A J85-5 engine will be instrumented for transient compressor testing, the instrumentation will be interfaced with a MOD COMP II computer system for storage and processing of test data. An analysis of the data will be made in order to relate specific aerodynamic parameters to changes in performance that result during transient operation that can lead to compressor stall.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0058, APPLICATION OF CATALYTIC COMBUSTION TO GAS TURBINE ENGINES
T.J. Rosfjord, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458230)

The objective of this work unit is to investigate the application of catalytic combustion to the primary combustor and afterburner of gas turbine engines. Goals of improved combustion performance and low exhaust emissions over the entire operational range of these components will be pursued.

Each of the four efforts described above is a small part of much larger projects being carried out in Room 20 and the J85 engine test. Projects 30480542 and 30660532 describe the operation of these facilities while other technical work is described in 30480569, 30480570, 30480571, and 30480526. Objectives of the subject testing have been selected to require minimum data acquisition time while technical orientation is towards specific problems, opportunities, or questions. each effort will require approximately two weeks of test time and will result in a technical report or paper. A coordinated plan has been established with NASA Lewis Research Center in this technical area. which allows AFAPL to maintain cognizance of the important results of their substantial effort while allowing rapid dissemination of AFAPL-generated knowledge.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0059, SIMULATION AND MEASUREMENT TECHNIQUES FOR RECONNAISSANCE SENSOR EVALUATION

T.V. Akers, U.S. Dept. of Defense, Air Force, Avionics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF084210)

To develop simulation, measurement and motion analysis techniques specifically for design integrity and performance evaluations of advanced reconnaissance sensors. Also to apply techniques for automated readout and data reduction to expedite the evaluation of sensors. The intent will be a documented body of knowledge concerning measurement and computational techniques applicable to performance evaluation, and means to more faithfully simulate actual operational situations.

Contractor has been provided access to former gun range at Area B, WPAFB and the accelerated runway for ground tests, up to 2000 feet range. Appropriate resolution targets and other photographic subjects have been acquired. The first major subtask has been to investigate the uses and limitations of a polar nephelometer to measure atmospheric scatter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Avionics Lab.

4.0060, GREEN LASERS FOR AIRBORNE HYDROGRAPHY

G.D. Ferguson, U.S. Dept. of Defense, Navy, Naval Air Development Center, Sensors & Avionics Tech Directorate, *Warminster, Pennsylvania* 18974 (DN081334)

To develop improved green light emitting, solid state and metal vapor lasers for use in naval coastal water hydrographic surveying from an airborne platform. A primary goal is to demonstrate reliable, short pulse width (35 NS) performance at a PRR of 400 Hz suitable for use in a helicopter environment. Another goal is to demonstrate reliable performance (1 MJ at 35 NS duration) at higher PRRs (24 kHz).

400 Hz Nd YAG laser develop stable resonator with angle tunable mirrors to correct for misalignment due to vibration. Test and evaluate brassboard laser system at 400 Hz. Develop reliable frequency doubler device. Evaluate various materials, matching fluids, optical coatings, and crystal oplishing techniques. Design and construct reliable crystal device. Test and evaluate performance with 400 Hz Nd YAG laser. Metal vapor laser - develop long life sealed metal vapor laser tube using improved ceramic metal seals. Evaluate operation in cavity dump mode for use in 24 kHz PRR range. Summarize results in technical report. Transfer technology with the development of components for use in the HALS (hydrographic airborne laser sounder system).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0061, STATISTICAL TECHNIQUES FOR SIGNAL PROCESSING

S.A. Kassam, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Systems Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DF046510; AFOSR-77-3154)

AF function - communications and signal processing. Deficiency -there exists a definite need for research in the area of nonparametric and robust statistical techniques which will result in simple and effective tests applicable to practical problems in communication and signal detection and processing. Objective - develop nonparametric and robust testing techniques which can maintain performance at some predetermined level for large classes of probability distribution functions. How work contributes - this research should lead to better design of communication systems and signal processing techniques.

The proposed research will be continued in the area of nonparametric and robust statistical hypothesis tests for signal detection. A new area of the proposed research is the study of distance measures and their application in the design of optimal systems, especially for hypothesis testing. Distance-measure concepts appear to hold considerable promise for useful results applicable to array processors and quantized data systems. It is also proposed to focus attention on sequential testing with particular emphasis on conditional test structures. Also a study will be made of the problem of correlated data for nonparametric hypothesis testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0062, MECHANISM OF INSERTION IN HIGH CONDUCTIVITY GRAPHITE INTERCALATION COMPOUNDS 15804-MS

F.L. Vogel, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering & Science, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DA0F9288; DAAG29-78-C-0037)

To understand and control the chemical processes of intercalation and de-intercalation, and to relate these processes to the electrical properties of the resulting materials. Relevance - the research is relevant to generation and transmission of electrical power, electronic warfare, composites for aircraft, mobility, etc. Electrical conductors which have conductivity/weight ratios greater than copper can have a great impact on the design of mobile power plants.

Preparation of materials from highly oriented pyrolytic graphite and intercalants such as iron halides and iron fluorides. characterization of the materials using combustion analysis, electron beam microprobe, x-ray fluorescence, gas phase ESCA and electrical resistivity. Determination of the degree of charge transfer during intercalation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0063, DIRECT DOPING OF SEMICONDUCTORS

J.N. Zemel, University of Pennsylvania, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *4001 Spruce, Philadelphia, Pennsylvania* 19104 (DF049850; AFOSR-77-3432)

AF function - microwave solid state devices are essential elements of Air Force communications, reconnaissance, surveillance and countermeasure system. Opportunity - as electronic devices become smaller and smaller, new technologies in device pattern generation will be required. Objective - it is the objective of this research to contribute to the development of submicron pattern generation. How work contributes - this work could lead to a simplified process for planar device fabrications.

As-S and As-Te-S-Ge chalcogenide amorphous films, which have differential chemical etching rates upon exposure to light, will be used as resists to establish patterns if these materials on the region of substrates or epitaxial films of Si and GaAs to be doped. After encapsulations, doping will be achieved by diffusing the unetched resist into the Si or GaAs to make devices.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0064, VIBROTHERMOGRAPHY - INVESTIGATION OF A NEW NONDESTRUCTIVE EVALUATION TECHNIQUE 16202-MS

K.L. Reifsnider, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Engineering Science & Mechanics, *Blacksburg, Virginia* 24061 (DA0G8959; DAAG29-79-G-0037)

To determine the mechanisms responsible for evolution of heat in mechanically loaded materials, especially in the neighborhood of materials defects, and to study limitations in techniques to detect the evolution of heat. Relevance - this research is relevant to the nondestructive evaluation of composite materials used in structures, penetrators, armor, helicopter and missile components, and to understanding of the mechanisms of fatigue failure in composite materials.

Isolation and characterization of the various processes known to generate heat in materials (plastic deformation, rubbing of mating surfaces, elastic hysteresis, release of strain energy, dispersion and attenuation of stress waves). Measurement of evolution of heat from a series of well-characterized flaws which are cyclically loaded. Modelling of the heat trans-

proach, here extended to include effects of atmospheric planetary wave propagation. Questions of prediction skill will focus on possible effects of wave-wave interaction on phase and group speeds of atmospheric planetary waves. A third area of investigation will concern possible specific configurations of an atmosphere which might be predictable over an anomalously long time in the sense of persistent finite amplitude solutions of model equations.

This research addresses one of the primary objectives of the Global Atmospheric Research Program (GARP) which is to extend the useful range of weather forecasting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0054, GEOLOGIC REMOTE SENSING

J.B. Adams, University of Washington, School of Arts & Sciences, Dept. of Geological Sciences, *Seattle, Washington* 98105 (NAGW 85)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

5.0055, SATELLITE OBJECTIVE FORECASTING

R.S. Hawkins, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF581920; F19628-78-C-0137)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of information to meet military weather support requirements. Objective - to develop automated techniques which utilize meteorological satellite data and, where necessary, conventional data in the objective specification and forecasting of mesoscale weather features. How development contributes -successful development of these techniques will allow automated forecasts of weather conditions at many locations satisfying AWS requirements specified in AWS TN 3-76.

Objective techniques will be developed using both satellite and conventional data. Use will be made of interactive data display systems to assist in identifying features of the satellite imagery and conventional data analyses that have potential as predictors. Tests will be made to evaluate how well forecasts with satellite data alone compare with those using conventional data as well.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0056, NAVY ENVIRONMENT - SUBMARINE AND AIRCRAFT PROFILING OF ARCTIC SEA ICE

R.W. Burling, University of British Columbia, Inst. of Oceanography, *2075 Wesbrook Pl., Vancouver, British Columbia, Canada* V6T 1W5 (DN675325; N00014-78-G-0003)

ASW/USW in the Arctic require definition of the environment in order to operate. For example, acoustic propagation transmission loss has been found to be directly related to underice roughness. The scientific objectives are to study the effects of wave-ice interaction and wave-induced fracture in the marginal ice zones of the east Greenland current and southern Baffin Bay. Applications of this research include ambient noise relationships to wave interaction with the edge of the pack and wave break-up of ice to ice thickness/distribution models.

Two field experiments will be carried out. One in September, 1979 will be based out of Mestersvig and one in March/April out of Holsteinberg. Danish and Canadian remote sensing planes will provide additional surface measurement of ice type and wave attenuation within the ice pack.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0057, FALL-OUT WINDS FROM SATELLITE RADIANCE OBSERVATIONS

G. Ohring, Tel Aviv University, Dept. of Geophysics & Planatary, *155 Herzl St., Tel Aviv, Israel* (DA0D9338; DAERO 77 G0051)

The major purpose of the proposed research program is to develop and test techniques for inferring effective fall-out winds directly from mix of satellite radiance and conventional (radiosonde) observations.

The proposed technique should enable a simple, quick, direct transformation of the satellite radiance observations to effective fall-out wind. The research will test and validate the technique on the sets of satellite and conventional (radiosonde) data available for White Sands Missile Range before testing the technique on field operational satellite and conventional observations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, BIOMEDICAL APPLICATION & HEALTH HAZARD ASSESSMENT OF OXYGEN ENRICHMENT BREATHING SYSTEMS

R.N. Armstrong, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0169)

To identify, assess, and prevent unnecessary health hazards associated with the flight environment and to obtain a biomedical data base on the human function associated with the use of aircraft oxygen enrichment breathing systems in the flight environment. To provide the Army data, information, recommendations and criteria to aid in the development and deployment of life support systems to alleviate identified health hazards.

The approach will consist of a biomedical evaluation of state-of-the-art oxygen enrichment breathing systems during aircraft ground and flight conditions. The evaluation will include the sampling of the environmental air input to the system as well as the system output, enriched air. The samples will be analyzed to determine the systems' ability to effectively filter contaminants known to exist in the operational environment. Physiological data, heart rate, oxygen tension and respiratory functions as well as system parameters, oxygen concentration, flow rates, temperatures and pressures will be collected during ground operations and aircraft flight at altitude to assess the ability of the system to provide aviators the required oxygen concentration and purity during various flight profiles. The data collected will be evaluated with respect to biomedical, safety, and man/machine limitations.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, ASUPT NIGHT SCENE EVALUATION

E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF222070)

To evaluate the extent to which simulator training using ASUPT reduced field of view night scene transfers to T-37 aircraft daytime training.

A data base on trials to proficiency in T-37 aircraft training on selected maneuvers has been developed in work unit 1123-01-14 under conditions of no ASUPT training and using the full ASUPT day visual scene. The proposed project will extend these data by providing training on selected maneuvers using the ASUPT night scene with a reduced field of view. A sample of UPT trainees will be trained using the same syllabus developed for the earlier study but restricting the ASUPT visual to a night scene and to a 28 degrees x 44 degrees FOV. Trials to

criteria on each maneuver will be recorded in the aircraft and these data compared to those compiled in the earlier study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, AFHRL/NTEC ASPT/AWAVS COOPERATIVE RESEARCH - CARRIER LANDING

R.R. Woodruff, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224190)

To determine pilots' ability to perform carrier landings using a wide field of view following training under either wide field of view or narrow field of view conditions.

A carrier modeled for use with the ANAVS will be displayed in the ASPT. Three groups of T-38 IPs will be trained in carrier landings. Group A will fly a circling approach and landing under wide FOV conditions, Group B will fly a circling approach and landing under narrow FOV conditions. Group C will fly a straight-in approach under narrow FOV conditions. After completing these training trials, the IPs in Groups B and C will fly circling approaches and landings under wide FOV conditions. The IPs in Group B will be provided audio or visual stimuli designed to cue them as to when they should begin their turn to final approach. The number of trials required to reach a criterion level of performance will be recorded and analyzed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, ABIOTIC SYNTHESIS - STUDIES OF POTENTIAL PRIMEVAL ATMOSPHERES AND THE DEVELOPMENT OF BIOLOGICALLY SIGNIFICANT MOLECULES

A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCA 2-675008)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, AIRCRAFT OXYGEN GENERATION BY MEMBRANE PERMEATION

D. Johnson, Garrett Corp., *2525 W. 190th St., Torrance, California* 90509 (DF324890; F33615-79-C-0609)

This effort is to design, construct and test a staged gas permeation system to demonstrate the technical feasibility of producing aviator's breathing oxygen from aircraft engine bleed air.

The use of membrane gas permeators offers an alternative technology for on-board generation of breathing oxygen, which may offer the advantage of 100 percent contaminant-free oxygen coupled with a low aircraft power penalty. Various types of membranes will be investigated for oxygen permeation. Based on this data, a model system is to be constructed capable of delivering 20 liters/minute of 90 percent oxygen and to determine the effect of operating parameters as feed pressure, temperature, and flow on oxygen concentrations. In addition, recommendations are to be included for up-grading the oxygen system to a prototype configuration which must provide 95 to 99 percent oxygen at flow rates up to 40 liters/minute.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0006, STUDY, COMPUTER-BASED LANDING SIGNAL OFFICER CARRIER AIRCRAFT RECOVERY MODEL

G. Borden, Human Performance Research Inc., *616 Carlo Dr., Goleta, California* 93017 *(DN894013; N61339-77-C-0110)*

In support of development of a trainer for landing signal officers (LSO), a study is required to expand a laboratory-developed preliminary model of ideal LSO 'waving' behavior to include precautionary and advisory calls. The model will be used to judge performance of student lsos during training.

Initial model bases power and waveoff calls (EMCON model) on three approach parameters. Expanding number of monitored parameters and degree of approach segmentation will allow all NATOPS calls to be generated.

SUPPORTED BY U.S. Dept. of Defense, Naval Training Equipment Center, Human Factors Lab.

6.0007, METABOLIC RATE AND THYROID FUNCTION IN THE MONKEY - SUBJECT OF THE COSMOS 81 MISSION

N. Pace, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physiology Anatomy, *Berkeley, California* 94720 (NAS 2-10658)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, ISOLATION OF CIRCULATORY INFLUENCE IN HIGH STANDARD GRAVITY

R.E. Burger, University of California, Davis Campus, School of Agriculture & Environmental Sciences, Dept. of Avian Science, *Davis, California* 95616 (DF049870; AFOSR-77-3430)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Deficiency - exposure to high sustained acceleration (HSG) produces myocardial pathologies in small mammals. Both subendocardial hemorrhages and cardiac myopathies have been observed in swine subjected to acceleration stress. Recently, similar pathologies have been discovered in avian species, suggesting an interspecies response and providing an excellent model for study. The possibility exists that man subjected to extreme acceleration stresses, as in the new maneuverable fighter planes, may be developing similar cardiac myopathies. The cause of these damages deserves investigation. Objective - this study will evaluate the component of arterial hypoxia in susceptibility to HSG, using domestic fowl as subjects. One can artificially maintain oxygenation via a catheter inserted into the air sac, a procedure that is not compatible with the thoracic respiratory system of mammals. This procedure removes ventilatory impairment as a factor determining response to HSG. How research contributes - this research will complement ongoing exploratory work at USAFSAM dealing with the effects of HSG on the cardiovascular system, with emphasis on 'g' induced cardiomyopathy. It directly supports subarea 1.6, 'Habitable Crew Environments in Air Force Operations.'

Estimate oxygen metabolism as a measure of circulatory impairment and potential myocardial susceptibility to HSG, calculate mixed venous oxygen concentration to aid in assessing perfusion abnormalities, determine RQ which will indicate the presence of absence ventilation perfusion inequalities, and estimate the contribution of arterial hypoxia on myocardial pathology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0009, AN EVALUATION OF MALE AND FEMALE ANXIETY DURING SERE TRAINING

D.C. Gillman, U.S. Dept. of Defense, Air Force, Air Force Academy, Behavioral Science & Leadership Dept., *Colorado Springs, Colorado* 80840 (DF282270)

AF function - technology base. Deficiency - adequate information on the response of AF cadets to stress-inducing situations at the USAF Academy is not available. Objective - the purpose of this study is to examine several aspects of anxiety and stress in second-year cadets participating in survival, evasion, resistance, and escape (SERE) training. How work contributes - the results of this study will make it possible to determine the levels of anxiety present in male and female cadets and to compare these anxiety levels with national collegiate norms. Further, it will determine how stable trait anxiety is, how much anxiety, stress, depression, and fatigue SERE training creates in men and women, and how stressful the SERE experience is compared to a normal college environment.

This effort is a continuation of work begun during the summer of 1977. Approximately 450 cadets from the class of

1980 were administered a questionnaire comprised of the following instruments: the Eight-State Questionnaire, Institute of Personality and Ability Testing (IPAT), Champaign, Illinois, the Anxiety Scale Questionnaire, IPAT, the Stressful Situations Questionnaire, Hodges and Felling, 1976, and specially constructed items dealing specifically with SERE training. These same instruments, with slight modifications, will be administered to the class of 1981 before and after SERE training during the summer of 1978. This pre-test/post-test design will detect any change in anxiety levels caused by SERE, and will yield valuable information about male versus female response to physically and mentally stressful experiences.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0010, HUMAN OPERATOR CONTROL STRATEGY MODEL

J.L. Birchfield, Georgia Inst. of Technology, Engineering Experiment Station, *225 North Ave. N.W., Atlanta, Georgia* 30332 (DF228160; F33615-77-C-0042)

Develop and validate a model of human operator control strategy on perceptual/motor tasks such as flying and investigate relationships between control strategy and cue utilization, learning, and changes in task variables.

Identify human operator characteristics that ought to be considered, develop an operational definition of control strategy, conceptualize and implement a model based on a defendable theory-of-control strategy development and learning, and conduct extensive validation tests. Milestones - contract award, 1 Apr 1977, theory development, 1 Oct 1977, model design, 1 Dec 1977, model testing, 1 Oct 1978, first TR, 30 Apr 1979, validation, Dec 1979, second TR, May 1980, optional demonstration, Oct 1980, final TR, Mar 1981.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0011, VENTILATORY CONTROL MECHANISMS AT HIGH ALTITUDE (22)

J.T. Maher, U.S. Dept. of Defense, Army, Medical Research & Development Command, Research Inst. of Environmental Medicine, *Natick, Massachusetts* 01760 (DA0B6132)

The physiologic processes which control the ventilation of man at high altitude are not fully understood. The objective of this work unit is to gain new knowledge of ventilatory control, with emphasis on adaptations within the control system during exposure to chronic hypoxemia, as experienced during sojourns at high terrestrial altitudes. A thorough understanding of this aspect of altitude physiology is essential in defining new approaches for enhancing the adaptation of the soldier to high terrestrial elevations.

An integrated program is under way to analyze contributions of both the carotid body and medullary chemoreceptors to the ventilatory adaptations of man to hypocapnic hypoxia, including interactions between the two chemoreceptors. Studies are also being carried out to determine contributions of the peripheral and central chemoreceptors to the increase in ventilation during muscular exercise exceeding the anaerobic threshold, as would be seen frequently at high altitude.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Research Inst. of Environmental Medicine

6.0012, CENTER OF EXCELLENCE FOR BIOMEDICAL APPLICATION OF ION THRUSTER TECHNOLOGY

D.F. Gibbons, Case Western Reserve University, School of Medicine, Dept. of Biomedical Engineering, *2109 Adelbert Rd., Cleveland, Ohio* 44106 (NAS 3-22443)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0013, BIOMECHANICS OF COCKPIT EVALUATION

W. Hovey, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF317180; F33615-78-C-0507)

To improve USAF's capability to provide human engineering support to the design and evaluation of crewstations by automating the complex operator/machine interaction by means of a three-dimensional interactive graphics computer model. To automate the handling of body-size variability data to improve the utility of these data to guide the design of AF systems and equipment. To provide computer techniques for evaluating the effects of flight clothing on operator's interaction with the crewstation. To provide computer methods for sizing and design of personal-protective equipment.

The utility of the COMBIMAN (computerized biomechanical man-model) will be enhanced by the expansion of data bases for clothing/personal-protective equipment and aircraft cockpits. Techniques for automated reach-task analysis will be improved. A technique for the elimination of hidden lines on the display will be developed. AMRL's force testing devices will be used to obtain male and female strength data for the design and placement of aircraft controls.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

6.0014, THE IDENTIFICATION OF PSYCHOPHYSIOLOGIC CORRELATES OF COGNITIVE PROCESSING

F.J. Bremner, Trinity University, School of Arts & Sciences, Dept. of Psychology, *715 Stadium Dr., San Antonio, Texas* 78212 (DF055850; F49620-79-C-0139)

AF function - a requirement exists for monitoring the brain activity of the pilot, evaluating his workload, his decision making ability, his workload processing ability, and his capability to respond to the system interface. Deficiency - the relationship of cortical events to the cognitive/information processing/decision making activities of mental processes has not been well documented. Also, it is not known how workload affects cortical events nor how fatigue affects electrophysiological correlates of cognitive processing. Objective - the research will (1) demonstrate the feasibility of using electrophysiological variables to assess the level of cognitive processing occurring at any given time in aircraft pilots, and (2) determine if variables previously shown to be potent in decreasing pilot effectiveness will also affect the electrophysiological variables associated with cognitive processing. How research contributes - the proposed research represents an initial attempt to explore and identify selected psychophysiologic correlates (electroencephalogram, visual evoked response, heart rate, and heart rate variance) of cognitive processing. In addition, it will be possible to evaluate the cortical effects of fatigue on these correlates.

Four subject groups will be selected. Group one will perform a high-cognitive processing task. Group two will perform a low-workload cognitive processing task. Group three will perform the high workload task plus be subjected to a situational state representative of cognitive fatigue. Group four will perform a non-cognitive processing control task. The dependent variables will be (1) electrophysiological, and (2) motor responses. The inherent EEG variables will be analyzed by means of a fast Fourier transform. The dependent variables will be submitted to a factor analysis. Results of the statistical treatments will identify predictor variables for future studies designed to expand current knowledge and use of brain monitoring technology in the context of the man/machine interface.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0015, AIR FORCE VALIDATION OF ASVAB FORMS 6 AND 7

J.J. Mathews, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233130)

To validate operational asvab subtests and composites against Air Force technical training performance criteria.

Current ASVAB tests will be correlated with technical training criteria. Some analyses will involve data which has been collected on 9,000 airmen experimentally administered ASVAB-7A. Possible sex and racial interactions in selector composite based prediction will also be investigated. In instances where feasible, new composites will be formed for appropriate technical courses. Operational ASVAB test data col-

lected at field stations (data will be obtained from MARDAC tapes) will also be validated, and comparisons will be made between experimentally and operationally administered test results. Milestones -- field tested samples selected - 1 May 77 to 1 Jul 77, operational test analyses - 1 Jul 77 to 1 Nov 77, interim TR preparation - 1 Nov 77 to 1 Mar 78, ASVAB7A samples selected - 1 Jun 77 to 1 Sep 77, ASVAB7A analyses - 1 Sep 77 to 1 Feb 78, administration comparison - 1 Mar 78 to 1 Sep 78, final TR preparation - 1 Oct 78 to 1 Mar 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0016, IMPROVED PRODUCTIVITY THROUGH USE OF INTRINSIC REWARDS AND FEEDBACK TECHNIQUES

R.D. Pritchard, University of Houston, School of Social Sciences, Dept. of Psychology, *3801 Cullen Blvd., Houston, Texas* 77004 (DF233260; F33615-78-C-0025)

The purpose of this research is to develop guidelines for implementing a set of effective feedback and goal-setting techniques in Air Force operational environments. These techniques concentrate on increasing the airman's motivation to perform through intrinsic motivation procedures applied at the level of the first-line supervisor. The guidelines developed will require a minimal amount of outside intervention into these organizations.

The determinants of feedback have been identified and narrowed to a number of optimal techniques that can be introduced into Air Force organizations. Three different types of organizations will be selected in which to field test these techniques. Productivity criteria will be located/generated for these organizations. After the techniques have been introduced, their impact on productivity and job satisfaction will be assessed. During the intervention phase, goal-setting techniques will be introduced in order to determine any additional benefits that might be incurred. A follow-up phase will investigate the long range effects of the intervention. The milestones for this work unit are: (1) site selection, 1 Jun 78-31 Jul 78, (2) design interventions, 1 Apr 78-31 Dec 78, (3) institute interventions, 1 Jan 79-31 Aug 79, (4) analyze data, 1 Sep 79-31 Oct 79, (5) write technical report, 1 Nov 79-31 Dec 79, (6) review and revise technical report, 1 Jan 80-29 Feb 80, (7) follow-up evaluation, 1 Jan 80-30 Apr 80, (8) submit final report, 30 Apr 80.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0017, ADVANCED HELMET-MOUNTED SIGHT (AHMS)

A.R. Deruyck, Polhemus Navigation Sciences Inc., *Burlington, Vermont* (DF322380; F33615-77-C-0513)

To design, develop and fabricate a laboratory grade advanced helmet-mounted sight (AHMS) system that will provide six degrees of freedom position information of a subject's helmet in suitable output format necessary for integrating it into the visually coupled airborne systems simulator (VCASS) program. Two additional objectives of this program are to develop a suitable integration of the AHMS system with state-of-the-art wide field-of-view (FOV) side-mounted helmet mounted display (HMD) optics and cathode ray tubes (CRT) and to develop a long range multiplexed AHMS system which will allow resolution of helmet position and attitudes at distances far greater than those required in high performance aircraft.

This effort will be divided into four phases: (1) conceptual design phase, (2) detailed design and fabrication phase, (3) test phase, and (4) engineering support phase. Each of these phases shall concentrate on four major areas of development- (1) primary AHMS hardware and programming, (2) hardware and programming for the long-distance multiplexed AHMS (LAHMS), (3) hardware and programming necessary to provide integrated HMD/AHMS (HAHMS), and (4) system electronics processing and control circuitry. Each phase has predetermined goals which must be met in each of these four areas before work can proceed into the next phase. Finally, sufficiently severe testing is performed in characteristic environments to assure that VCASS requirements are met and that system viability for a follow-on airborne qualified system is achieved.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DATA MANAGEMENT AND LANGUAGE ENHANCEMENT FOR GENERALIZED SET THEORY COMPUTER

G.T. Finley, University of the District of Columbia, Undergraduate School, *4100 Connecticut Ave. N.W., Van Ness Campus, Washington, District of Columbia* 20008 (NAG 5-91)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0002, PIPLINE PROCESSOR DESIGN FOR COMMUNICATION SYSTEMS

G.K. Maki, University of Idaho, School of Engineering, Dept. of Electrical Engineering, *Moscow, Idaho* 83843 (NAG 5-93)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0003, IMPROVING COMMUNICATIONS BETWEEN HUMANS AND COMPUTER-DIRECTED AUTOMATIC SYSTEMS

C.J. Rieger, University of Maryland, College Park Campus, Graduate School, Dept. of Computer Science, *College Park, Maryland* 20742 (NAG 5-99)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

7.0004, NONLINEAR PROBLEMS OF CONTINUUM MECHANICS AND MATHEMATICAL PHYSICS

M.S. Berger, Inst. for Advanced Study, *Princeton, New Jersey* 08540 (DF051360; AFOSR-78-3558)

AF function - aerospace vehicle design techniques. Deficiency -weight reduction and other optimization leads to large structural distortions which are not well understood. Objective - to improve the self-consistency and rigor of existing mathematical techniques and create new ones. How work contributes - through more dependable mathematical models.

Nonlinear problems in continuum mechanics and mathematical physics exhibit unique properties such as solitons, or bifurcation which are important to future engineering design. Techniques to be applied include functional analysis, calculus of variations in the large, and a study of the singularities of mappings. Applications may be expected in areas including the structural stability and plasticity of thin shells, parametric instability and resonance for Hamiltonian autonomous systems, soliton perturbation and superconductivity.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, A CHRONOLOGICAL ANNOTATED BIBLIOGRAPHY ON ORDER STATISTICS

H.L. Harter, Wright State University, School of Science & Engineering, Dept. of Mathematics, *Dayton, Ohio* 45431 (DN075036; N00014-80-C-0067)

Extreme values play an important role in the performance of naval vehicles, including, for example, gust loads on aircraft or ships and weakest components in complex systems. It is highly desirable to have a systematic, orderly study of order statistics, the branch of statistics concerned with extreme values.

the quenching coefficient will be determined. The spectral distribution of the chemiluminescence will be obtained, and the photon emission rate constant will be measured for the individual bands as well as the total radiation. B) Ground based observations of the hydroxyl emission in the various vibrational bands, and verification of spatial emission irregularities by scanning the celestial hemisphere with a narrow field-of-view photometer. C) Computerized modeling of the hydroxyl airglow based on best available density profiles of hydrogen and ozone, and the laboratory determined rate constants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, LANDSAT CAPABILITIES FOR GENERAL WETLANDS MAPPING

J.K. Stoll, U.S. Dept. of Defense, Army, Corps of Engineers, Waterways Experiment Station, *P.O. Box 631, Vicksburg, Mississippi* 39180 (31585)

OBJECTIVES: To develop a capability to use LANDSAT data for detecting areas with a high potential for being identified as wetlands by Corps field offices and for mapping their locations, to apply that capability in selected Corps Districts for evaluation, and to establish criteria for use of the capability.

APPROACH: The Corps has established two centers for production work in the interpretation of LANDSAT imagery for the National Dam Safety Act as the most cost-effective manner of providing this type data to the field offices. These are the Eastern and Western Regional Data Analysis and Management Centers (DAM Centers), located in Nashville and Seattle Districts, respectively. These centers will be proposed as the production centers for wetlands mapping. Procedures for wetlands mapping will be developed and the technology transferred to the DAM Centers for use. A joint NASA Johnson Spaceflight Center (JSC/Corps) development program will be established to make optimum use of the computer procedures presently available to the DAM Centers, which procedures were initially developed through JSC. Procedures for wetlands mapping other than those developed in conjunction with JSC will also be reviewed for possible alternate use by the DAM Centers either as procedures separate from those the Centers now possess or as modifications of available Center software. Periodic contacts will be maintained with other government agencies and private and academic institutions through informal conversations and symposiums to ensure that the most technically advanced procedures will be reviewed for possible use. Test sites will be chosen in selected Corps Districts for in-depth evaluations of candidate LANDSAT interpretation procedures. LANDSAT interpretation procedures will be used to provide data for these test sites, and the data evaluated by a comparison with the on-the-ground situation. The DAM Centers, WES, and District personnel will be involved in the evaluation. The production procedures will be developed in a phased manner, starting with the simplest and least expensive, but potentially usable procedures, and refining the procedures on the basis of the product evaluations. The Dam Centers will be provided with a workable procedure. Documentation of the evaluated procedures will be provided as a guide to the DAM Centers and Corps District offices in the use of the DAM Center products.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Waterways Experiment Station

5.0022, DEFINITION OF OCEAN SURFACE BOUNDARIES USING SYNTHETIC APERTURE RADAR

P.E. La Violette, U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity, Naval Oceanographic Lab., *Bay St. Louis, Mississippi* 39529 (DN894453)

Determine if quantitative analysis of data from satellite/aircraft synthetic- and real aperture radars (SAR and SLAR), scatterometers, and radar altimeters can be used to derive distinctive sea state patterns indicative of the surface position of ocean current boundaries.

The experiment described herein is the third phase of a joint U.S.-Canadian experiment taking place in the region between 42 degress and 53 degrees W and 38 degrees and 47 degrees N. This third phase called 'keystone', will utilize aircraft SAR, SLAR, scatterometers, and radar altimeters in comparison with conventional oceanographic and remote sensing instrumentation to make a year-long examination of a large cyclic thermal structure in the study area. The data platforms will consist of seven satellites, one research aircraft, two research vessels, and an array of nine deep-moored current meters.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0023, NAVY ENVIRONMENT - SATELLITE ALTIMETRY

A. Gordon, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DN875360; N00014-75-C-0210)

Remote sensing by satellite altimetry from SEASAT may offer a technique of determining the position of ocean tides, fronts, or eddies from the relative heights of the ocean surface. This technique is exploratory and depends on the accurate removal of geodetic features and resolution of the residual signature.

SEASAT-A altimeter data from the northwest Atlantic will be collected and the calculated geoid signature removed. The residual data will be analyzed for physical oceanographic features relating to frontal and eddy positions. The resulting analysis will be compared to surface measurements for ground truthing. Evolution of transient features will be studied as well.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0024, GROUND AND TROPOSPHERE LOW FREQUENCY EFFECTS

J.L. Heckscher, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF904160)

Development of an in-house theoretical and experimental capability to predict and measure low frequency radio propagation over irregular, inhomogeneous terrain. Development of techniques to determine earth characteristics which influence the ground wave. Improvement of methods of incorporating physiographic data into the equations of ground wave propagation. Study effects of troposphere inhomogeneities on ground wave stability. Improve and extend VLF/ELF systems by identifying and measuring electrical noise caused by motion of aerosphace vehicles through the troposphere. Refine new techniques for advanced detection of dangerous charge build-up in clouds, to improve lightning warning and to provide the basis for lightning damage avoidance systems.

The in-house theoretical capability will be accomplished beginning with existing 'residue series' ground wave propagation equations for the smooth round earth formulated by Van Pol and Bremmer and used by Wait and Johler and continuing with the integral equation approach development by Hufford and others. The equations will be cast into forms suitable for high speed digital computation and numerical predictions for specific paths will be compared. The experimental capability will be realized with construction of equipment to transmit LF pulses having only one or two radio frequency cycles. In conjunction with existing digital receiving techniques, this short pulse device will constitute a precision tool for the measurement of LF propagation. Soil characteristics represent one of the least well known of the various factors required for accurate ground wave prediction. Inversion of the integral equation results in a solution for the surface impedance in terms of the attentuation function and the path topology. A hybrid method, to account for terrain irregularities by a perturbation of the smooth round earth solution, may result in a significant reduction in computation time. Stability will be studied by observing time-of-arrival of LORAN pulses, using ultra-stable cesium standards as the local reference. Improved VLF/ELF reception on aircraft will be sought by studying techniques which can either reduce the sensitivity of the receiving system to the noise, or which can act directly to diminish the intensity of the noise itself. A new prototype electrograph will be built and installed at CCAFS, so that a comparision study with a radar display can (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

5.0025, GAS CORRELATION FOR HYDROCARBONS
D.E. Burch, U.S. Environmental Protection Agency, *Research Triangle Park, North Carolina* 27709 (DF336420)

To determine the feasibility of using a gas correlation method for the remote (non-contact) sensing of hydrocarbon pollution generated by Air Force operations. Presently available point monitoring sensors have proven unreliable or inappropriate for determining the contribution of airfield operations to local environmental quality. A remote system would provide an integrated pollutant load.

Joint funding with EPA. An existing gas correlation instrument will be modified to sense hydrocarbons. High resolution spectra will be furnished by the EPA project officer for use by the contractor to determine the most promising approach.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

5.0026, NIMBUS 6 CLOUD EVALUATION
K.N. Liou, Utah Higher Education System, University of Utah, School of Mines & Mineral Industry, Dept. of Meteorology, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (DF581910; F19628-78-C-0130)

AF function - weather observation, analysis and forecasting. Deficiency or opportunity - limited ability to specify and forecast cloud conditions in real time. Objective - develop techniques to parameterize weather satellite microwave and infrared imagery data for the inference of cloud properties. How development contributes - a successful development will lead to improved cloud detection from satellites and improved input to cloud forecasting models.

For a variety of cloud conditions, radiances measured by the NIMBUS 6 satellite will be compared to conventional sources of weather data. The observed radiances will also be compared to radiances calculated from a model of radiative transfer in cloudy atmospheres for ice and water clouds over a range of visibilities and thicknesses. Combinations of microwave and infrared channels which best identify cloud properties will be sought.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, OCEANOGRAPHIC APPLICATIONS OF MAGSAT
R.D. Regan, Phoenix Corp., *1700 Old Meadow Rd., McLean, Virginia* 22101 (DN994453; N00014-79-C-0653)

Provide technical support to NORDA for comparative analysis of satellite, shipboard, and airborne geomagnetic data sets, assist in the statistical comparative analysis of the ship, air, and satellite data sets as they relate to crustal and tectonic studies of the earth's lithosphere and in the preparation of a final report summarizing the applicability of satellite magnetic measurements to these studies.

(a) Development and implementation of computer programs to convert these data sets to image formats compatible with NORDA's I2S 101 computer, (b) development of a procedural manual for the analytical display of the converted data on I2S 101 computer, (c) development and implementation of an interactive computer program for three-dimensional modeling of magnetic source bodies utilizing the I2S 101 computer, and (d) development and implementation of plotting programs for display of satellite residual data sets by specified parameters (time, position, altitude, external field indices).

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Ocean Research & Development Activity

5.0028, SPREADING OF AIRCRAFT EXHAUST
N.W. Rosenberg, Tel Aviv University, *155 Herzl St., Tel Aviv, Israel* (DF584130; F49629-79-C-0180)

AF function - environmental impact assessmants of AF operations in the upper troposphere and lower stratosphere. Deficiency or opportunity - at present little is known about the horizontal dispersion of pollution from an aircraft in the region mentioned above. Satellite observation gives, for the first time, an opportunity to obtain data on a global scale of radial growth of aircraft vapor trails. At the polar regions this would involve penetration into the stratosphere and thus allow comparison between tropospheric and stratospheric dispersion. How research contributes - this information is expected to show how variation of altitude, season, latitude, etc. affect horizontal dispersion of A/C pollutants in the upper troposphere and lower stratosphere at early times. Such information could then be coupled with other data and with models in order to estimate pollution effects with greater than the present accuracy.

The goal is to obtain statistical information of vapor trail growth rates from commercial jets by means of an analysis of satellite images.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, FEASIBILITY OF DOSIMETER FOR AMINE BASED FUELS EXPOSURE
R. Elersick, Abcor Inc., *850 Main St., Wilmington, Massachusetts* 01887 (DF320890; F33615-77-C-0618)

Since NIOSH/OSHA standards for occupational exposure to toxic chemicals emphasize time weighted average exposure, a device for determining such exposure to amine based propellants is required for Air Force use. Colorimetric dosimeters have been developed but they lack required sensitivity and are subject to interference. Solid sorption procedures are available, but they require air pumps to collect the sample. A simple badge type dosimetric device, small, sensitive and interference free that can be easily read in the field or alternatively at a central laboratory is desired.

The desired approach to a dosimetric device is the application of diffusion across a semipermeable membrane. Study of appropriate membranes and diffusion parameters for hydrazine, unsymmetrical dimethyl hydrazine and monomethyl hydrazine will be undertaken, emphasizing the effects of ambient temperature, pressure, humidity and air movement. Appropriate detector materials/systems to be used behind the membrane will be selected to afford necessary sensitivity and simplicity of detection. Specificity may be controlled by the membrane, the detector or the measurement method. Several candidate devices will be fabricated for laboratory evaluation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0002, MALE/FEMALE DIFFERENCES IN FLYING SKILL ACQUISITION, FLIGHT SAFETY AND ACCIDENT PRONENESS, AND MOTIVATION FOR FLYING
J. Zvara, Aerospace Systems Inc., *121 Middlesex Tpke., Suite 202, Burlington, Massachusetts* 01803 (DF232860; F33615-77-C-0028)

To investigate civilian male/female differences in flying skill acquisition, flight performance and safety, and motivation for an interest in flying.

A threefold approach will be utilized. First, a review of civilian aircraft accident data will be undertaken with an emphasis on determining if either sex appears disposed towards a greater incidence or type of accidents. Second, a field survey will be administered to a sample of 750 FAA flight instructors, and third, a field survey will be administered to samples of 750 male and 750 female FAA pilots. The emphasis of the field survey will be to determine the existence and possible impact of sex difference. Milestones: Stage I, review of literature, 1.5 months, Stage II, preparation and approval of survey instruments, 3.0 months, Stage III, investigation of accident data (partly concurrent with Stage II), 1.5 months, Stage IV, survey administration, 2.5 months, Stage V, analysis, 2.5 months, Stage VI, preparation of final technical report, 3.0 months.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, THE INVESTIGATION OF METABOLIC AND CARDIOVASCULAR RESPONSES TO FATIGUING STATIC EFFORT

A.R. Lind, St. Louis University, School of Medicine, Dept. of Physiology, *1402 S. Grand Blvd., St. Louis, Missouri* 63104 (DF034830; AFOSR-76-3084)

AF function - endurance and fatigue and their relationship to aircrew performance is of utmost interest to the Air Force. Basic questions regarding the comparability in skeletal muscle strength and endurance between men and women is particularly significant to the USAF because of the current emphasis on full utilization of women--including flying. Deficiency - understanding the relationships between the electrical activity of contracting muscles and the generation of fatigue remains incomplete. This research may provide us with an important key to examine the course of fatigue (electrical or mechanical or a combination of both) or to provide evidence of muscle composition, by types of motor units, especially in regard to differences that may exist between strength and endurance in males as compared to females. Objective - this effort will focus attention on the investigation of the ability of females to exert isometric strength and endurance after fatigue. The physiological responses of the women subjects will also be measured. How research contributes - this research directly addresses research needs identified under subarea 1.4.

Experiments using male and female subjects will be conducted to investigate the causes of muscular fatigue and the differences in those causes that exist between men and women. Aspects to be studied include relationships between isometric strength and endurance at four different sub-maximal tensions, at varying muscle temperature, assessment of loss of isometric endurance in successful contractions held to fatigue when the intervals between contractions is varied 3-20 mins, determination of the rate of recovery of muscles to exert maximal strength and to sustain sub-maximal isometric contractions after the development of fatigue at varying tensions less than MVS, measurement of local blood flow to muscles performing sustained sub-maximal tensions at controlled muscle temperature in women as compared to men.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0004, VESTIBULAR SYSTEM RESPONSE TO ACOUSTIC ENERGY

D.E. Parker, Miami University, Graduate School, Dept. of Psychology, *Oxford, Ohio* 45056 (DF313120; F33615-76-C-5029)

Air Force function - operational stress, environmental acoustic hazard to aircrew personnel. Deficiency - the manner in which high intensity acoustic energy contributes to disorientation in Air Force crewmembers is very poorly understood. Research - investigate the manner in which acoustic energy stimulates the vestibular system. How research contributes - research will indicate how high intensity noise affects equilibrium and produces disorientation. Results will contribute toward the development of threshold criteria for hazardous exposure to high intensity sounds.

This research will better define the dynamic response of the vestibular system to acoustic stimulation, in terms of intensity level, acoustic frequency (Hz), and intermittency rate of the stimulus. Thresholds will be determined for nystagmic and counterrolling eye movements, and postural adjustments. A study of the nature and mechanisms of the transfer of acoustic energy to the vestibular system will be made by studying stapes displacement and perilymph and endolymph pressure changes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0005, ANALYSIS OF AERODYNAMIC DECELERATION INJURIES DURING EMERGENCY ESCAPE

S.P. Combs, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321450)

Injuries caused by aerodynamic deceleration during emergency escape from high performance aircraft using open ejection seats are a serious problem under non-combat conditions and a major combat ejection problem. These injuries, which may be life-threatening at their onset, also increase the possibility of fatality in final phases of escape, i.e., parachute opening shock, descent, landing impact, post-escape survival and rescue. Aeromedical criteria must be established to support development of protective equipment. The objective of this effort is to: (1) provide medical descriptions of operational injuries, (2) determine the injury mechanisms, (3) establish a basis for prioritizing biomechanical research on this problem and (4) provide aeromedical criteria for injury prediction models and protection techniques.

All accident reports from 1965 to present in which there is a possibility of injury from aerodynamic deceleration will be reviewed in detail. The review, accomplished in collaboration with the deputy inspector general for inspection and safety, will include analysis of ejection conditions, flight surgeon's evaluation of injuries, X-rays and long-term effects of the injuries. Injuries occurring during the investigation will be studied directly on a physician to physician basis. Research results will be made available to the Naval Air Systems Command as well as USAF laboratories and product divisions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, BIOASSAY IN SOIL MICROORGANISMS

S.A. London, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320500)

To utilize microbial systems for evaluating the potential environmental impact of various materials used in Air Force operations, such as missile propellants, aircraft fuels and lubricants and other substances used in consequential amounts that could have acute and/or chronic environmental effects. The data derived from this effort are considered in conjunction with similar results obtained with other biological indicator and test systems to form a data base upon which scientifically valid environmental impact assessments and statements can be prepared. The microbial bioassay portion of work unit 6302-04-11 was transferred to this work unit.

Microbial cultures isolated from soil samples will be investigated concerning their responses to both acute and chronic exposure to potential environmental pollutants. Selection of species will be based upon (1) applicability of physiological requirements to experimental procedures, (2) relationship of responses to pollutant exposure with ecosystem impact. Microbes will be studied under both closed (batch) system and open (steady state growth) system conditions to ascertain acute and chronic effects. Responses to be evaluated will include growth kinetics, bacteriocidal/bacteriostatic effect, physiological changes, genetic (mutation) effects, pollutant degradation or accumulation. This effort will establish no-effect levels for single and multiple cultures and will serve as both a laboratory test system and a means of predicting potential environmental consequences of inadvertant intrusion in soil and water of Air Force materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0007, MATS WIDE FIELD-OF-VIEW DISPLAY

G.R. McMillan, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325570)

To upgrade the multi-axis tracking simulator to permit presentation of wide angle, out-of-the-cockpit visual information. This upgrade is necessary to: 1. Conduct an analysis of pilot utilization of rotational motion cues in the presence of a wide field-of-view display, 2. Develop a manual control based technology to quantify and model the performance effects of complex wide field-of-view visual information, and 3. Provide human performance trade-off data to ASD that may be used in the design of simulator visual and motion systems. This work is in direct support of TN-ASD-AFHRL-AMRL-0602-77-66.

The upgrade will begin with a design study to be completed in mid-FY80. Fabrication of the display and projection systems and software development is planned for FY80-81. The display will be integrated with the mats cockpit and motion base at this point and experimentation will begin. An expansion of the graphics capability is planned for FY82. It is anticipated that

the system will consist of a fixed-base hemispherical dome using projected television imagery.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0008, OPTICAL PROPERTIES OF WINDSCREENS

R.C. Seid, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF321110)

To develop new measurement techniques for evaluating cockpit windscreen optical characteristics. To measure and quantify the optical characteristics exhibited by experimental and actual aircraft windscreens, using both existing and new optical measures. To analyze the optic performance of the design windscreens for the F-111 using computer ray-tracing techniques, assist in relating the optical characteristics of these, and similar, transparencies to specific functional effects on the human visual system (work unit 71841803). The ultimate product of this workunit will be to recommend a specific set of optical measures that will be used in acceptance testing of aircraft windscreens.

Historically, a number of optical tests have been devised in an effort to quantify the optical characteristics of windscreens. None of these measures has proven to be infallible. In the previous work unit (71841204) several new measures of windscreen optical quality were being explored. These included multiple imaging, optical fourier analysis, angular deviation, binocular disparity and birefringence coloration. By comparing optical measures made on the windscreens with pilot acceptance and/or visual performance (see work unit 7184-18-03) it will be possible to determine which of these optical tests correlates with vision. Predistorted panels have been fabricated to be used in relating optical measures to vision. Windscreens and new panels having different characteristics and geometrics will be used during the course of this work. The windscreen measurement lab and the image metrics facility will be used in accomplishing this work. Disciplines involved are optics, physics, and experimental psychology. Field data from F-111 windscreens will be obtained and compared with the optical measures developed for the previous workunit. Computer ray trace of the F-111 windscreen will be accomplished for determining design-inherent angular deviation, binocular disparity and multiple imaging. This will be compared with actual measures to determine how much of the problem is due to manufacturing and how much is inherent in the design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0009, TRANSMISSIBILITY CHARACTERISTICS OF THE PRIMATE SPINAL COLUMN

A.R. Slonim, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF324110)

To determine the extent and characteristics of transmissibility of motion up the spinal column of the rhesus monkey and baboon. This effort will examine also the nature (e.g., phase change) of the response of the anterior and posterior portions of the spinal column. These data should provide some insight into the transmissibility of vibration in the spinal column of man, with the ultimate objective of developing a model for predicting vibrational effects on both primate and human spinal columns, as well as developing criteria and protective measures for the safety of crewmen in aerospace operations.

Primates will be surgically prepared with implanted accelerometers at different locations on the spinal column and then exposed to vibrations of low frequency (below 100 Hz). A series of four experiments will be conducted over a period of one year. The first experiment will evaluate the effect of vibration on rhesus monkeys with two implanted accelerometers, one at an upper thoracic level and the other attached to the sacrum. A second series of experiments will utilize baboons instead of rhesus monkeys. The third group will add a third accelerometer on the baboon at the lower thoracic level. The latter will be on the posterior column, while the upper thoracic accelerometer will be on the anterior column. The first three series will utilize three primates each. The fourth series will utilize up to 7 baboons in which the intervertebral discs have been removed at one or more levels to gain further insight into the mechanics of transmissibility of motion through the spinal column. In all experiments, an attempt will be made to correlate the response resonances observed with various physiological variables and later with resonances predicted from mathematical models of transmissibility.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0010, DEVELOPMENT OF DESIGN CRITERIA FOR RAPID PRE-EJECTION CREW RESTRAINT

L.J. Specker, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322370)

Injuries resulting from exposure to aerodynamic forces during emergency escape using open ejection seats are a major problem. The solution requires both ejection seat stability and limb restraint and both are interrelated, i.e., the lack of one will aggravate the other. The restraint system must provide complete protection during escape but not encumber the crewmen during normal flight and thus compromise the mission. Furthermore, in multiplace aircraft restraint must be quickly and automatically applied on pilot command to properly preposition and protect crewmen who are not prepared to eject. The objective of this research is to define design criteria for mechanisms which will automatically position and restrain crewmen in an optimum body posture for safe emergency escape. The criteria will include minimum actuation times, maximum retraction forces and velocities, and body segment restraint sequencing timing.

Experiments will be conducted using a special test fixture consisting of an ejection seat mockup and a system of hydraulically actuated devices which can independently or sequentially retract shoulder straps, lap belt arm restraint, and leg restraint. Volunteer subjects will be automatically restrained utilizing varying initial body positions and retraction speeds. Retraction force-time histories, impact forces and body segment accelerations and trajectories will be measured during each test. Data collected during these tests will be studied using a mathematical model of the human body, the restraint system, and the retraction device. The mathematical analysis will permit a parametric analysis of the restraint system design criteria and prediction of injury modes as well as performance of the protection system under adverse flight conditions. The resulting design criteria and analysis will be provided to the aeronautical systems division for incorporation into system development specifications and the AFSC design handbook series.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0011, SIGNIFICANCE OF ARTERIOGRAPHIC MINIMAL CORONARY ATHEROSCLEROTIC HEART DISEASE IN THE AIRCREW MEMBER

R. Anthracite, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF321920)

Minimize the number of flyers who must be grounded because of the presence of minimal coronary artery disease that is functionally insignificant, establish techniques to detect disease progression/regression, evaluate the effect of risk factor modification on the progression of the disease, and establish the significance of given lesions on long-term prognosis for the purpose of establishing retention criteria.

Aircrew members identified as having minimal coronary atherosclerotic heart disease (i.e., a degree of obstruction associated with a coronary event rate that is no greater than that observed in an apparently healthy similar aged population not subjected to cardiac catheterization) will be followed longitudinally with serial risk factor assessment, noninvasive tests (e.g., exercise stress testing) and coronary arteriography to establish significance of given lesions and the influence of risk factor modification on disease progression. Newer noninvasive techniques used to assess the functional capacity of the coronary circulation will be correlated with the results of cardiac catheterization in

an attempt to reduce the frequency of the latter procedure at no expense to flying safety and mission completion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0012, CONTACT LENSES AND KERATOCONUS
T.J. Tredici, U.S. Dept. of Defense, Air Force, School of Aerospace Medicine, *Brooks Air Force Base, San Antonio, Texas* 78235 (DF323030)

The objective of this work unit is to evaluate and follow selected USAF aircrew personnel with visual disorders, principally corneal, requiring contact lenses to maintain their visual function. Particular emphasis will be placed on those individuals with irregular astigmatism and keratoconus. This work unit will also include a group of individuals who prior to entering flying training had refractive errors altered by a technique known as orthokeratology. A small number of patients who underwent this form of 'treatment' and who appear to be developing a corneal dystrophy (keratoconus) have now been identified. The possibility has to be explored that this may have been hastened or caused by the orthokeratology procedure. The permanence of this procedure (alteration of the refractive error) has been questioned and therefore follow-up examinations might better help in answering these questions.

Patients to be included in this study will be identified primarily from referrals to the Aeromedical Consultation Service from base-level flight surgeon's offices Air Force-wide and to a lesser extent from MAJCOM and Hq USAF referral. Referral will usually be based on the fact that the patient cannot be corrected to 20/20 visual acuity with spectacle lenses. The scope of each evaluation will be dictated by those elements indicated from the patient's condition. Extensive baseline data from the initial evaluation will be used in assessing changes in ocular status over time. Each follow-up examination will result in a new recommendation regarding fitness for continued flying duty. Work on this unit was formerly conducted under 7755-09-04.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0013, EXPERIMENTAL METHODOLOGIES FOR MANNED SYSTEMS TECHNOLOGY
R.C. Williges, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Industrial Engineering, *Blacksburg, Virginia* 24061 (DF324870; F33615-78-D-0629)

There is a requirement to extend existing - and develop new -methods for performing experiments on complex systems, particularly simulated systems. Manned AF systems and their simulations are multidimensional (i.e., they are characterized by a large set of potential design parameters) and their performance varies dynamically in real-time. In order to study the behavior of such systems for the development of improved design principles, appropriate experimental methodologies must be made available. These methodologies must be able to deal with the problems of system multidimensionality, system dynamics, use of teams of operators, performance optimization as a function of design variables, etc.

Under this task, the state-of-the-art in the area of experimental methodology for systems (primarily simulation) research will continue to be evaluated. The results of previous AMRL RPV systems simulation studies will be examined for methodological difficulties and to determine areas where appropriate methods are lacking. Also, critical issues and an experimental protocol specifying research required for this area of effort will be identified. It is anticipated that at least one formal study using AMRL's team-in-the-loop RPV simulation will be conducted to address issues involving performing time series analyses on dynamic systems performance data.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, CONTROL AND COMMUNICATION SYSTEMS APPLICABLE TO THE DESIGN OF AEROSPACE SYSTEMS
A.V. Balakrishnan, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF051350; AFOSR-78-3550)

AF function - design of advanced aircraft control systems. Deficiency - the unification of the separate efforts in structures, aerodynamics, stability and control, and propulsion is needed in early design phases. Objective - the objective of this workshop is to bring together almost all leading researchers in stochastic partial differential equations. How work contributes - success in this objective would contribute to the assessment of the field of stochastic partial differential equations and for indicating which methodologies might be appropriate to further explore for potential applications in the near future.

Approximately 15 participants would be invited. The majority of the participants would be established experts in the field. Others will be chosen from a group of aspiring new promising researchers who have demonstrated solid technical competence in stochastic partial differential equations. This should encourage communication between theoretical and applied researchers, provide greater visibility to young and promising researchers, and bring their fresh insights and interests to the attention of more senior researchers. The proposed workshop will serve as a vehicle for dissemination of research results and potential applications in this area to the various practitioners using these techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0002, AIRFOILS AT SONIC VELOCITY 14309-E
J.D. Cole, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (DA0E9259; DAAG29-78-G-0008)

To construct in a systematic manner some lifting airfoil flows with sonic freestreams for realistic shapes. Relevance - the research is highly relevant to the necessity of establishing accurate far-field boundary conditions and bench-mark test cases for finite difference solutions for transonic flow being developed at AMRDL.

The small disturbance equations for two-dimensional sonic flows past airfoils is transformed into the hodograph plane where solutions are constructed for lifting airfoils by properly superposing singular solutions representing the correct freestream singularity and behavior at the nose region.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

7.0003, PROBLEMS IN STABILITY ANALYSIS OF FINITE DIFFERENCE SCHEMES FOR HYPERBOLIC SYSTEMS
M. Goldberg, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Mathematics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF044280; AFOSR-76-3046)

AF function - the study of nuclear weapons effects on aerospace vehicles and ground structures. Deficiency - stable high order accurate numerical schemes are needed for computing flow shocks, contact discontinuities and gradients. Objective - this research intends to study high order accurate finite difference schemes which are usable in the area of the shock and the region behind the shock. How work contributes - could eliminate the need of mixed order accurate schemes when computing shocks.

The stability of finite difference schemes for hyperbolic partial differential equations will be investigated. The aim is to achieve better understanding of stable computational techniques for initial value, this includes smooth problems in the quarter space, as well as Cauchy problems whose solutions contain shock-waves or other types of discontinuities. The investigations

will include the particular norm properties of the generalized numerical radii, which are helpful in investigating linear stability of difference approximations in several space dimensions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0004, STRUCTURE OF MATERIALS, ELECTROMAGNETIC SCATTERING AND FLUID DYNAMICS

R.P. Gilbert, University of Delaware, School of Arts & Sciences, Dept. of Mathematics, *Newark, Delaware* 19711 (DF041300; AFOSR-76-2879)

AF function - design of aerospace vehicles. Deficiency - more critical design criteria require more exact evaluation involving additional physical effects. Objective - increased understanding of the equations of fuel tank oscillations, aircraft panel flutter, structural stability and vibration, etc. How work contributes - improved analysis of these less familiar models may suggest methods of control.

Three areas will be investigated. The theory of isotropic but inhomogenous elastic systems will be generalized to include first anisotropic inhomogenous systems and then the layered systems found in composite structures. Deterministic detonation-deflagration models will be extended to include random distributions of reactive sites in the material in an attempt to model hot spots, metal particle inclusions, etc. in actual explosives. Inverse and improperly posed problems in heat conduction and wave propagation will be studied both by regularization and by analytic continuation techniques such as the catalogue of solutions technique used by Garbedian and Korn in shock free transonic wing design.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0005, RELATIVE EQUILIBRIA OF THE N-BODY PROBLEMS

J.I. Palmore, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Mathematics, *Urbana, Illinois* 61801 (MCS78-00395 A01)

This is a continuation of work supported by MCS-78-00395.

Work to be done will concentrate on investigations into degenerate relative equilibria classes of n-body problems of celestial mechanics. Of primary concern will be the question of whether there are only finitely many relative equilibria classes in the n-body problem when n exceeds three.

Work will also be done on several problems which derive from the study of critical point theory using a distinguished family of potentials. This will include classification of relative equilibria of Kirchhoff's problem of vortices and determination of bifurcation at degenerate critical points.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0006, PHASE TRANSITIONS - CRITICAL BEHAVIOR AND METASTABILITY

C.M. Newman, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Mathematics, *Memorial Hall, Bloomington, Indiana* 47401 (MCS77-20683)

This continues research previously supported by NSF MPS74-04870A01. Two topics in the theory of phase transitions will be investigated in the context of Ising ferromagnets and related quantum field models: the nature of critical points and the nature of metastability. A combination of probabilistic and bifurcation-theoretic techniques will be applied to an analysis of (block-spin) scaling limits at the critical point. Metastability near a first order phase transition will be studied in terms of the analyticity of eigenvalues (of the transfer matrix); in particular, a rigorous proof will be sought for the conjecture that in a classical nearest neighbor Ising model below the critical temperature (and in related quantum field models), the imaginary axis (of the external field variable) is not a natural boundary for the thermodynamic functions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0007, DYNAMICS OF GALAXIES

C. Lin, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (MCS78-04888)

Renewal of MCS-7513878.

The investigators will tackle some major unsolved galactic problems, with a new emphasis on related topics in plasma physics. These will include the maintenance of spiral structure, global instabilities of disc-shaped galaxies, barred galaxies and their properties, the evolution of nuclear species in galaxies, nonlinear effects in density waves, and other topics. Partial progress has already been made in some of these areas.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0008, NUMERICAL STUDIES IN COMPUTER-AIDED DESIGN

D.A. Calahan, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Electrical & Computer Engineering, *Ann Arbor, Michigan* 48104 (DF041990; AFOSR-75-2812)

AF function - to develop computational tools for solving important problems in fluid mechanics, nuclear weapons effects, and weather prediction. Opportunity - a family of computers with special architecture, the vector processor, is becoming available for the solution of these problems. New ideas concerning algorithms and architectural modifications for those computers may bring about a significant increase in processing speed deemed as necessary for the solution of 3-D full Navier-Stokes equations. Objective - this effort will look into those algorithmic and architectural modifications which may accomplish the desired increase in processing speeds. The goal is to obtain one billion floating point operations per second. How work contributes - techniques and ideas generated under this research will influence the development of future processors for the benefit to all concerned.

The following tasks are proposed: (1) To extend studies modeling timing efficiency, etc., to hierarchically structured computers. (2) To continue to develop their sparse equation solution software to process block structure and to study input/output complexity of large sparse systems of equations. (3) To construct a simulator for the CRAY-2 computer which is now being designed. (4) To convert a 3-D Navier-Stokes program to vectorized FORTRAN and partially to CRAY assembly languages.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0009, OPTIMAL AND INSENSITIVE CONTROL OF HYPERBOLIC DISTRIBUTED PARAMETER SYSTEMS WITH APPLICATIONS TO WING FLUTTER PROBLEMS

D.L. Russell, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Mathematics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DF054020; AFOSR-79-0018)

AF function - the design of wing flutter suppression systems. Deficiency - there has been no optimal control policies developed to suppress wing flutter problems. Objective - the objective of this research is to explore new ideas in the areas of wing flutter suppression systems. How work contributes - success here would expand the lifetime of the aircraft inventory in addition to expanding the operating environment.

The investigation will begin in four unique but related areas. First, the model of wing flutter phenomenon will be refined to include actual aerodynamic and control forces typically affecting the wing structure in addition to the boundary conditions. Second, the linear quadratic optimal control methodology

applied to linear hyperbolic systems will be studied to answer questions about the spatial smoothness properties of the feedback kernel in addition to the study of the Liapounov equation. Third, an extension of results on robustness and insensitivity to hyperbolic systems will be pursued. Finally, a control law must be based on a finite number of measurements and these must be based on a numerical solution of the system. A number of methods will be investigated to determine which method is well suited for this problem.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, PROPERTIES OF CONDUCTION ELECTRONS IN METALS

R.W. Stark, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DMR79-10533)

Experimental studies of low temperature electronic transport in metals which previously were supported by NSF grant DMR7703683AO1 will be continued. The research that will be carried out involves studies of electron interference effects in the metals, magnesium and nickel. The de Haas-van Alphen effect in ferromagnetic nickel will also be studied. The investigations will be performed at temperatures between 0.02 degrees K and 10 degrees K. The electron interference studies in magnesium will aim to determine the strength of electron-electron scattering between two electron quasiparticle states at the Fermi energy. Studies of the electron interference effect in dilute magnesium alloys will attempt to resolve the question of whether these alloys are ordered. The studies in ferromagnetic nickel will be aimed at determining the details of the exchange interaction and its temperature dependence. In addition the temperature dependence of the electron quasiparticle states in nickel will be investigated. These investigations will provide a basis for improved understanding of basic electron transport mechanisms in pure or nearly pure metals.

This is the first year of a three year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, THEORETICAL STUDIES OF INHOMOGENEOUS ELECTRONIC SYSTEMS IN SOLIDS

H.B. Shore, California State University & Colleges, San Diego State University, School of Sciences, Dept. of Physics, *5402 College Ave., San Diego, California* 92115 (DMR79-20813)

Theoretical investigations in solid state physics previously supported by NSF grant DMR 77-11532 will be continued and extended in new directions. The density functional method will be applied to inhomogeneous electron-hole systems in semiconductors. The properties of bound and unbound multiexciton complexes and small electron-hole drops will be calculated using an atomic-like 'shell model' and compared with experiments on work functions, spectral properties, and nucleation properties of small complexes. Investigations will be conducted on the character of collective excitations such as plasmons and capillary modes in small complexes. Density functional theory will be used to determine the ground state energy of clusters of impurities in semiconductors, in order to gain insight into the importance of clustering in impurity band information. In addition, the density functional method will be applied to problems in electron gas theory. Previous calculations on Wigner crystallization will be extended and applied to two dimensions. Similar methods will be used to investigate the onset of charge-density waves in a jellium model. Calculations on the metal-insulator (Mott) transition will be performed for a model system consisting of a lattice of point charges in an electron background. These calculations will be repeated for alkali metal lattices. Particular attention will be paid to the problem of electron self-interaction in limiting the validity of the density functional method.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0003, POPULATION DISTRIBUTIONS IN ATOM-MOLECULE REACTIVE COLLISIONS

R.K. Nesbet, International Business Machines Corp., Research Laboratory, *Monterey & Cottle Rd., San Jose, California* 95114 (DN975491; N00014-79-C-0406)

The composition of the ionosphere is important since it determines the characteristics of radio communication in the ionosphere. In order to understand this composition and how it can change due to various disturbances, rate constants for many types of molecular collisions are required. This work is concerned with developing techniques for computing inelastic and reactive cross sections, and cross sections for electron scattering by molecules.

A quantum dynamical entropy is being calculated as a function of the reaction coordinate for a number of different collision systems. This will yield insight into the maximum entropy postulate of information theory. A new technique for performing classical trajectory calculations has been proposed which will enable one to employ powerful techniques available in bound state classical mechanics to scattering problems.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0004, PHOTODISSOCIATION AND PHOTODETACHMENT OF ATMOSPHERIC NEGATIVE IONS IN THE ULTRAVIOLET

J.T. Moseley, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF053360; F49620-78-C-0119)

AF function - Air Force operations related to communications and surveillance require detailed information of atmospheric electron and ion densities which are important in the normal and disturbed environment. Deficiency - there is a lack of photodissociation and photodetachment cross sections for input into atmospheric modeling codes. Objective - the goal of this research is the measurement of photodetachment and photodissociation cross sections for a number of ions of importance in the atmosphere from 1700 to 4300 A. How work contributes - knowledge of these cross sections will permit better information to be input into atmospheric modeling codes.

Ion swarms formed in a drift tube apparatus will be impinged upon by lasers in the wavelength region from 1700 to 4300 A, and a mass spectrometer will be used to measure loss of parent ions and appearance of photofragments. Thermalized ions of important atmospheric species will be formed and will constitute the ion swarm. Photon fluxes in the range 50-5000 w/sq. cm will be employed. Wavelength and mass selection will be performed with highly automated, computer controlled instrumentation and state-of-the-art lasers in the ultraviolet will be used. Absolute photodissociation and photodetachment cross sections will be measured.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0005, DEVELOPMENT OF THE DESIGN OF MOLECULAR STRUCTURES

W.A. Little, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (INT79-18025)

This award will support Professor William A. Little of Stanford University in California for a period of two years in a program of cooperative research with Professor H. Kuroda of the University of Tokyo in Japan for the purpose of studying the design and synthesis of molecular structures for specific technological purposes. The project will focus on problems associated with forming prescribed structures composed of complex organic molecules rather than on the structure of the molecules themselves. Consideration will be given to systems such as organic metals and super conductors, artificial muscles and artificial enzymes, and molecular-specific sensing devices. This project is sponsored jointly by NSF and by the Japan Society

for the promotion of Science under the U.S.-Japan Cooperative Science Program.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

8.0006, MATERIAL SUPPORT TECHNOLOGY - TUNNELLING INVESTIGATION OF QUASI-ONE-DIMENSIONAL MATERIALS

P.M. Chaikin, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DN675684; N00014-76-C-1078)

The Navy has need for new electronic materials that offer improved performance in operational systems. This program will provide needed information on the electronic properties of a class of materials that holds promise for such increased capabilities in communications and surveillance.

The investigator will use electron tunnelling to investigate a series of quasi-one-dimensional materials of considerable current interest. These materials fall into the categories of polysulfur nitride, the charge transfer salts based on tetracyano-quinodimenthane (TCNQ), and metallo-organic salts based upon platinum cyanide (KCP). All have unusually anisotropic electronic and vibrational properties and undergo phase transitions at low temperatures that are associated with Peierl's distortions. Studies in polysulfur nitride will focus on the temperature dependence of the superconducting energy gap while those in the TCNQ salts will initially focus on the phase transition.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0007, THEORETICAL HIGH ENERGY PHYSICS

J.M. Cornwall, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY7821502)

Research will be done in theoretical physics to further our understanding of the elementary particles, of quantum field theory, and of many-body theory. Topics will include: 1) Broken chiral invariance; 2) Confinement and quantum chromodynamics; 3) Dynamical symmetry breaking; 4) Gauge theory, applied especially to the strong interactions; 5) Relativistic many-body theory; 6) Descriptions of the weak interactions alternative to the Salam-Weinberg-GIM model; 7) Neutral currents; 8) Phenomenology; 9) Supersymmetry.

This work is a continuation of that currently supported under NSF Grant PHY76-23467 A02, and this award will be the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0008, SPECTROSCOPY OF ELECTRONS IN INVERTED METAL OXIDE SEMICONDUCTOR STRUCTURES

R.G. Wheeler, Yale University, Graduate School, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (DMR78-20071)

Research on the quasi-two-dimensional electronic subbands in a semiconductor surface inversion layer, previously supported under grant DMR 7514026, will be extended to very thin (5-10 nm) oxide structures. In this regime electron-electron interactions are deemphasized, thus narrowing the energy width of the subband levels and modifying the infrared tuning characteristics of the silicon MOSFET (metal-oxide-semiconductor field effect transistor). Infrared spectroscopy, photoconductive and Hall effect measurements will be made on (100) and (110) silicon surfaces and a search undertaken for a new effect, plasma resonances in the non-continuum region.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, AMORPHOUS ALLOY PHYSICAL PROPERTIES AT LOW TEMPERATURES

D.G. Onn, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (DMR80-06641)

This is a continuation of studies on thermal and magnetic properties of amorphous binary alloys (i.e., Ni-B, Fe-B, and Cu-Zr) and the more complex transition metal-metalloid quaternaries and penternaries. Measured properties will be related to current structural models of these materials, and when needed, structural studies will be done by Professor T. Egami at the University of Pennsylvania. The objective is to understand electronic and phonon behavior obtained from low temperature thermal and magnetic measurements, in terms of structural details. This is a continuation of research, previously funded under NSF Grant DMR77-21657A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, PLASMA THEORY

T. Coffey, U.S. Dept. of Defense, Navy, Naval Research Lab., *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN980032)

The LINUS program at NRL is attempting to apply imploding liner flux compression techniques and advanced plasma source techniques to the generation and confinement of high energy density plasmas. Such techniques have application to high pulsed power generation, nuclear fusion and nuclear weapons effects simulation. NRL has developed techniques for stabilized liner implosions in which the liner motion is contractible and reversible. This is in contrast to the more conventional explosively-driven liners. The objective of the present program is to provide the theoretical support needed for the interpretation of experimental results and their extrapolation to larger systems.

This project will utilize advanced techniques in plasma physics and fluid mechanics for modeling the dynamics of imploding liners, liner magnetic field interface and the properties of liner compressed plasmas. The program will be significantly integrated with ongoing experimental activities at NRL.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0011, SERIES EXPANSION METHOD FOR MAGNETIC SYSTEMS WITH SINGLE-ION ANISOTROPIES

Y. Wang, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (DMR79-25369)

Research previously supported by DMR7721539.

Theoretic research in the properties of magnetic materials will be carried out. In particular, the consequences of including crystal field effects will be explored. A series expansion method will be developed which will include these effects, especially the anisotropic potential seen by a magnetic ion. This method will be capable of improved predictions of critical temperatures and for the behavior of magnetic solids in the paramagnetic phase. Several materials, such as antiferromagnetic rare earth compounds, will be studied by this method.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, X-RAY STUDIES OF SOLID-STATE PROPERTIES - VALENCE CHARGE DENSITIES AND ACOUSTOELECTRICALLY AMPLIFIED PHONONS

R. Colella, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (DMR77-27534)

Professor Colella's laboratory is developing techniques for inferring structural properties of solids from the diffraction of monochromatic X-rays. One part of the work is concerned with the nature of bonding in tetrahedrally coordinated semiconductors, specifically the III-V compounds. The details of the electronic structure, in particular the distribution of the valence (bonding) electrons, is open to question. To address this issue,

Colella collaborators very carefully measure the intensities of quasi-forbidden X-ray diffraction peaks to infer the interatomic electron distribution. Extension of this work is concerned with the variation of bonding charge density as a function of applied pressure up to 100 Kbar in order to distinguish between effects due to thermal vibrations and changes in interatomic distances.

The second part of this work uses observation of satellite peaks on the wings of double-crystal X-ray diffraction peaks to observe acoustoelectrically amplified phonons (lattice vibrations). Use of this X-ray scattering technique permits study of crystals opaque to useful optical radiation. Under study are the anharmonicity of the acoustoelectric atomic vibrations; relation of anomalous transmission to momentum exchanged in the scattering process; and, use of time resolved experiments to discriminate between primary phonons and those generated through wall reflection and other processes.

This is a continuation of work supported under DMR 77-06744. It is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, SURVEILLANCE - X-RAYS EMITTED FROM HIGHLY IONIZED ATOMS

B. Curnutte, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (DN323076; N00014-75-C-0490)

This research provides data for developing models for understanding the properties of highly ionized atoms and interactions of these systems with other atomic species. Since these atomic species occur in high temperature plasmas and violent collisions, understanding their properties and interactions is important to the Navy from the standpoint of modeling nuclear weapons detonations with high temperature plasmas, studying solar activity which affects the ionosphere and studying the effects of a nuclear detonation on the environment.

The LAMB shift in O(7 plus) will be determined by measuring the polarization components of the radiation from the stark mixed S(1/2) and P(1/2) states. The polarimeters for similar measurements in hydrogen-like silicon and sulfur will be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0014, HYPERFINE INTERACTION STUDIES IN METALS, WITH APPLICATION TO CRITICAL PHENOMENA

C. Hohenemser, Clark University, School of Arts & Sciences, Dept. of Physics, *Worcester, Massachusetts* 01610 (DMR80-02443)

Differential perturbed angular correlation and Mossbauer effect measurements will be carried out to study magnetic critical phenomena. In particular the effect of random disorder on the static critical behavior of iron-aluminum alloys, of nickel-iron and nickel-cobalt alloys, and of nickel-palladium alloys will be investigated. Further, the dynamic critical behavior of cobalt and of gadolinium just above their Curie point will be studied. Finally, studies of the dynamic critical behavior of several disordered ferromagnets (nickel-iron alloys, nickel-cobalt alloys, and nickel-palladium alloys) will also be pursued.

This research was previously supported under NSF Grant No. DMR77-012550.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0015, ENERGETIC PARTICLES AND MAGNETIC ACTIVITY

P.M. Hagan, Emmanuel College, Graduate School, Dept. of Physics, *400 the Fenway, Boston, Massachusetts* 02115 (DF582660; F19628-79-C-0102)

AF function - communications, surveillance and navigation. Deficiency - lack of understanding of magnetosphere and inability to predict solar particle effects on atmospheric and ionospheric conditions. Objective - define the charged particle population and magnetic field configuration in the interplanetary medium and the earth's magnetosphere developing models and characteristic indices.

Design, develop and fabricate hardware modifications for the AFGL magnetometer network interfacing hardware with system software and with the data processing programs to provide increased system reliability and ease of utilization. Design and fabricate hardware to measure energetic particle fluxes, to discriminate species and to perform energy analysis. Match instrumentation to available satellite rides performing integration and calibration as required. Analyze data returned or recovered emulsion packages and perform payload simulation studies to verify observed results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

8.0016, THEORY OF QUANTUM FLUIDS

C.E. Campbell, University of Minnesota, Minneapolis Campus, Inst. of Technology, Dept. of Physics & Astronomy, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (DMR79-26447)

Research previously supported by DMR7809226.

The objective of this project is an understanding of the microscopic structure of quantum fluids and how it relates to experiment. The central focus is liquid helium, including adsorbed helium monolayers. Some work on nuclear matter and classical fluids is also planned.

Topics to be investigated include the structure of the ground state of liquid helium-4 including triplet and pair-pair correlations; Raman, neutron and x-ray scattering in liquid helium-4; the structure of the core of a vortex in helium-4; the structure of the ground state of fermion liquids (helium-3 and nuclear matter); the liquid structure function and magnetic susceptibility of helium-3; the density profile of the surface of liquid helium-3; the phase diagram of helium-3-helium-4 mixture; the phase diagrams of helium monolayers adsorbed on graphite; and the three-body distribution function in classical fluids.

The most reliable interparticle potentials available will be used in the models of these systems. Because of the ubiquitous strong, short-range repulsions, this places a heavy emphasis on an adequate theory of short-range correlations. Consequently, the predominant theoretical approach used will be the method of correlated basis functions and generalizations of Jastrow theory.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0017, STUDY OF PROPERTIES OF HETEROJUNCTION STRUCTURES FOR MICROWAVE DEVICES

L.F. Eastman, Cornell University, Ithaca Campus, School of Electrical Engineering, *Ithaca, New York* 14850 (DN575176; N00014-75-C-0739)

Future developments and improvements in solid state microwave devices for navy systems will result from better understanding of how material properties affect device operation. Thin film electron devices are very sensitive to processes which occur at interfaces between two solid materials. This research will study parameters which affect the performance of microwave devices in gallium arsenide and alloy III-V semiconductors.

There are three facets to this program with the focus on the growth and preparation of thin film heterostructures of the III-V compound semiconductors and subsequently their application to microwave devices. Molecular beam epitaxy (MBE) and liquid phase epitaxy (LPE) techniques will be developed and improved in order to form heterostructures with low impurity content. Controlled doping of layers of various binary and ternary semiconductors will be used to form high resistivity layers for buffer layer-heterojunctions for field effect transistors (FETs). Electrical measurements will be made and the results used to influence the MBE growth techniques. Auger electron spectroscopy, photoemission spectroscopy, scanning Auger microscopy, scanning transmission electron microscopy will be used to analyze the compositional properties of the heterojunc-

tion interfaces. This information will be correlated with the electrical measurements and MBE growth developments.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0018, THEORETICAL STUDIES OF EFFECTS IN TETRAHEDRAL SEMICONDUCTORS

J.A. Van Vechten, International Business Machines Corp., *P.O. Box 218, Yorktown Heights, New York* 10598 (DF055210; F49620-79-C-0077)

AF function - this proposed research primarily falls in the 2.3 research objective which deal with forms of matter which possess the ability to generate, detect, process, control and otherwise usefully employ electromagnetic energy for military-related purposes. These include man-made artifacts which underlie most of the semiconductor devices, infrared detectors, electroacoustic elements, transducers, lasers, radiation resistant devices, non-linear optics, integrated optics and numerous other devices and components. Deficiency - new or improved materials are needed capable of serving as window materials in the 1-6 micron wavelength of chemical lasers and the 10.6 micron wavelength of water lasers. The chemical lasers require materials chemically inert to attacks of HF or DF. Particular research attention should be paid to the minimizing of absorbing inclusions, the temperature variation of refractive index, optical absorption and other important materials parameters. Objective - 1) the identification, by means of simple estimates of thermochemical parameters and analysis of the thermal history of a given sample, of the chemical and structural nature of the defects that ought to be present in the given sample, and 2) the theoretical determination of the electric and optical properties of these expected defects for comparison with available experimental data. Contribution - this research is a part of a comprehensive program in radiation interaction with matter.

The PIs plan to continue their study of the behavior of dislocations. In addition to their interaction with light and with carriers, they are studying the effects of electric field, strain and impurities. They have in progress a study of the effect of various electrolytes and potentials upon the quality of Si, wafers sawn from a boule. The investigators have found that a significant improvement in the depth and nature of potential can be detected. Now that the question whether vacancies or self interstitials are the dominant native defect in Si, GaAs, etc. is settled, they will return to the program they intended to pursue before this controversy arose, namely, will take estimates of the heats of formation, of migration, and of kinetic factors, such as surface reconstruction, which affect the concentration of defects incorporated into the crystal during growth and high temperature processing. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0019, WEAPONRY - X-RAY AND ELECTRON SCATTERING COMPTON PROFILES

L.B. Mendelsohn, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DN223481; N00014-75-C-0475)

When x-rays interact with atomic systems many processes such as ionization and Compton scattering occur. In order to predict the effect of x-rays the cross sections for the various processes are required. These processes are of interest to the Navy since large fluxes of x-rays and neutrons are produced by nuclear detonations. Understanding their effect on the ionosphere and the environment requires a knowledge of these cross sections.

Distorted wave calculations of Compton profiles for electron and x-ray scattering from atoms are being performed to try to obtain better agreement with experiment than Born calculations yield. Relativistic Hartree-Fock incoherent scattering factors for x-rays are being computed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0020, INTENSE RELATIVISTIC ELECTRON BEAM INVESTIGATIONS

W.O. Doggett, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (DF056980; AFOSR-80-0051)

AF function - the AF has requirements for the development of weapons effects simulators, new microwave sources for advanced radars and electronic countermeasures, and advanced weapons concepts. Deficiency -no laboratory device can realistically simulate the radiation environment of a nuclear weapon. No conventional accelerator can maintain accelerating fields of megavolts per centimeter over many meters. Radar systems are not available which can locate and provide images of remote satellites in high orbits around the earth. Objective -the objectives of this work are 1) to characterize and enhance collective ion acceleration in vacuum diode geometries, 2) conduct an experimental investigation of the dielectric cathode guide phenomena to understand the basic mechanisms involved in the transport of relativistic electron beams, 3) experimentally determine the density and rotation rate profiles for a nonneutral electron beam propagating in an axial magnetic field in a conducting pipe, and 4) to develop techniques to focus relativistic electron beams into radii of the order of 0.1 mm. Contribution - the beam focusing and dielectric cathode transport studies are important for the development of pellet fusion X-ray sources. The collective ion acceleration work contributes to the development of advanced concepts.

The collective ion acceleration research will emphasize the Luce vacuum diode geometry and is aimed at determining the mechanism involved in the acceleration. Experiments will be conducted on the low impedance (7 ohm) Marx charge machine at NCSU. To characterize the dielectric guide cathode, optical techniques will be used to measure the breakdown velocity. These include fiber-optic light pipes coupled to photomultiplier tubes and image converter camera pictures. A laser scattering technique will be used to measure the electron and ion density and the temperatures in the diode plasma. A q-switched ruby laser beam will be focused onto a small spot of diameter less than a millimeter and the scattered light will be collected and dispersed by a spectrometer into adjacent wavelength detection channels. The knowledge of these parameters in the diode plasma on a time resolved basis should be useful in evaluating the collective ion acceleration mechanism. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0021, ACOUSTICALLY INDUCED MODE SWITCH IN OPTIC FIBERS

E.F. Carome, John Carroll University, School of Arts & Sciences, Dept. of Physics, *20700 N. Park Rd., University Heights, Cleveland, Ohio* 44118 (DN880070)

Investigate those interactions of acoustic radiation with light propagating in optical fibers which result in amplitude effects due to acoustically induced mode switching. The techniques developed in this study will be transferred to NRL (code 0130) by John Carroll University (JCU) personnel.

Collimated incoherent optical sources of various wavelengths will be utilized to excite selected groups of propagating modes in optical fibers by varying imput angle. The degree of acoustically induced mode switch will be measured. Detailed computations will be made of intensity distributions produced by a small number of specific modes propagating in step index fibers. The techniques and software developed and results obtained will be transferred to NRL (code 0130) where they will be utilized in the evaluation of various fibers as potential acoustic sensor elements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

8.0022, COMMUNICATIONS - ATOMIC AND MOLECULAR INTERACTIONS

R.M. Herman, Pennsylvania State University, University Park Campus, School of Science, Dept. of Physics, *211 Whitmore Lab., University Park, Pennsylvania* 16802 (DN723885; N00014-75-C-0741)

Optical communications are of interest ot the Navy. The objective of this work is to examine some of the problems associated with optical frequency standards in atomic systems.

The approach used will be to theoretically study the effects of pressure on quantum beat spectroscopy and to arrive at an understanding of how intraatomic coherence may be destroyed or transferred in atomic collisions following sudden excitation. The theoretical techniques used will be the resolvent operator and density matrix formalism of quantum mechanics and the radiation field will be treated quantum electrodynamically. The results of this study are expected to provide new information on processes affecting precision spectrosopic studies of atomic systems on the interatomic forces affecting various excited state atomic properties, and on spin exchange processes in excited atomic systems. Of special interest is the newly discovered phenomenon of collisional transfer of quantum beats to transitions in which none would be allowed in the absence of collisions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0023, STATISTICAL MECHANICS AND THEORY OF SOLIDS

H.B. Callen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DMR79-10153)

Research previously supported by DRM76-21703.

Theoretical research in condensed matter physics will be carried on in a number of areas: (1) Phase transitions in random systems, including spin glasses and percolation phenomena. (2) Phase transitions in liquid crystals. (3) Statistics of linear and branched polymers, including the gelation and vulcanization transitions. (4) Orientational properties of solid hydrogen. (5) Magnetic properties of rare earth chalcogenides. (6) The physics of magnetic bubble and related devices.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0024, MILLIKELVIN STUDIES OF SOLID HELIUM-3 MAGNETIC EFFECTS AND SUPERCONDUCTING AMORPHOUS TRANSITION METALS

W.P. Kirk, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR80-11384)

Nuclear magnetic resonance techniques will be used to study the magnetic susceptibility, spin diffusion, spin relaxation times and the phase diagram of solid helium-3. These studies will be performed for various molar volumes of the solid and as a function of applied magnetic field. In order to facilitate a more comprehensive study of solid helium-3 at low temperatures, new types of pressure sensors will be developed. Heat capacity and thermal conductivity measurements will be made on selected amorphous transition metal alloys.

This is a continuation of research supported under DMR-7810808, and is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, ELECTRONIC PROPERTIES OF METALS AND ALLOYS IN HIGH MAGNETIC FIELDS

R.V. Coleman, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-02553)

The electronic structure and properties of layer crystals exhibiting charge density wave (CDW) transitions will be investigated experimentally. Measurements of quantum oscillatory phenomena at high magnetic fields will be made on single crystals of layer structure dichalcogenides and trichalcogenides. DC transport measurements including Hall effect, magnetoresistance and superconducting anisotropy will also be carried out. Both Shubnikov de Haas and de Haas van Alphen oscillations will be measured using AC modulation and harmonic detection. These techniques are being extended for use on the high field Bitter solenoids at the National Magnet Laboratory. Charge density wave formation in the chalcogenides will be studied and the effects of organic intercalation and pressure on the CDW will be followed by measuring the quantum oscillatory phenomena. DC susceptibility, Hall effect and magnetoresistance as a function of temperature will also be used to correlate results with CDW formation.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, STUDY OF SURFACE VIBRATIONAL MOTION BY ELECTRON ENERGY-LOSS SPECTROSCOPY - NEW THEORETICAL FORMULATION & INTERPRETATION OF EXPERIMENTAL RESULTS

S.Y. Tong, University of Wisconsin, Milwaukee Campus, School of Engineering & Applied Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (11584-AC5,6)

We propose to formulate a microscopic theory to calculate the intensity spectra of high resolution electron energy-loss spectroscopy. We treat accurately the strong short-range interactions between vibrating surface molecules and the incoming electron beam. This new formulation will be used to analyze experimental data taken on various chemisorption systems. Recent studies with this surface technique indicate that the measured data, when properly analyzed, can provide sensitive information on adsorption species, orientation and site arrangement of molecules adsorbed on metal and semiconductor surfaces. The theoretical formulation will be the first detailed microscopic theory that treats the short-range electron energy-loss scattering exactly. Our initial investigation will concentrate on the physical origin of 'negative-ion' resonance peaks: the extraction of adsorbate-substrate structural information from the angular and energy intensity profiles. This latter information is valuable to the field of surface crystallography. In particular, the information obtained by the technique will be used to compare with those obtained by low-energy electron diffraction spectroscopy.

SUPPORTED BY American Chemical Society

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOLAR POWER SATELLITE POLICY ISSUES

Unknown, U.S. Congress, Office of Technology Assessment, *119 D St. N.E., Washington, District of Columbia* 20510

This assessment is reviewing the environmental impacts connected with microwave and laser transmission from space to earth, and the potential effects of launch vehicles on the atmosphere. The project will evaluate public perceptions of these issues.

SUPPORTED BY U.S. Congress, Office of Technology Assessment

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, PLANETARY INVESTIGATIONS AT THE OWENS VALLEY RADIO OBSERVATORY

D.O. Muhleman, California Inst. of Technology, Owens Valley Radio Observatory, *1201 E. California Blvd., Pasadena, California* 91109 (AST79-11806)

A program of planetary observations at the Owens Valley Radio Observatory will be carried out during the next three year period using the new millimeter wavelength systems. Single disk measurements of the CO absorption lines in the atmospheres of Venus, Mars and Jupiter will be continued on the 10 meter telescope. Single disk continuum measurements of the brightness temperatures of Saturn's satellite, Titan, and the Jovian satellites, Io, Europa, Ganymede and Callisto will be at-

tempted during the current fiscal year, but accurate work will require the use of the MM-wavelength interferometer during 1980. The satellite observations in conjunction with thermal infrared observation will be used in the formulation of thermophysical models of these objects. The continuum interferometer system will be used to measure the limb and pole darkening characteristics of the atmospheres of Venus, Jupiter, Saturn, Uranus and Neptune. These data will be interpreted in terms of the vertical temperature profiles, opacity sources and anomalous polar hood effects. Later in the period, spectral line interferometric observations of CO (and possible other species) in the atmospheres of Venus and Mars will be made to investigate upper atmospheric dynamics on these planets. CO is an excellent atmospheric tracer for the investigation of planetary circulation phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0002, THE SELF-REGULATING INJECTION MODEL OF COSMIC RAY ORIGIN

D.S. Eichler, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST80-02673)

Numerous astronomical phenomena (supernovae, solar flares, quasars, radio galaxies) produce relativistic particles. There is a very basic problem in determining how these high energy particles obtain their energy from these sources. The theory of formation of these particles (cosmic rays) will form the basis of the studies to be made under this grant. In particular, the following areas will be emphasized: 1. The composition of galactic cosmic rays will be calculated. 2. Other astrophysical phenomena, such as the expected range of gamma ray fluxes from supernovae remnants and the ionization rate of interstellar atoms due to cosmic rays, will be determined. 3. The question of collisionless shock structure at very high Mach numbers will be examined.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0003, COSMIC RAY ANISOTROPY, SOLAR MAGNETISM AND HELIOMAGNETOSPHERE

H.S. Ahluwakia, University of New Mexico, School of Arts & Sciences, Dept. of Physics & Astronomy, *University Hill N.E., Albuquerque, New Mexico* 87106 (ATM78-10727)

This award will support an attempt to understand the observed day-to-day and the long-term changes in the parameters of the diurnal, the semidiurnal and the tridiurnal components of the solar daily variation of cosmic rays, in an attempt to arrive at a unified theory of the anisotropies of solar origin which contribute to these ordered interplanetary magnetic fields, far away from the plane of the ecliptic, will be explored in detail. This study might make it possible to draw certain inferences regarding the broad scale ordering of the interplanetary magnetic field and the time variations in it, over a solar cycle. One can compare these inferences with the predictions of theoretical models.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0004, HIGH-RESOLUTION OBSERVATION OF PLUTO/CHARON AND POSSIBLE MULTIPLE ASTEROIDS

J.D. Mulholland, University of Texas, Austin Campus, School of Arts & Sciences, Dept. of Astronomy, *200 W. 21st, Austin, Texas* 78712 (AST79-24550)

It is proposed to use the Mark II electrographic camera of the McDonald Observatory to attempt to obtain resolved images of a suggested satellite of the planet Pluto and of a gravitationally bound multiple asteroid system. The high sensitivity and resolution of the electrographic camera will be used during short intervals of excellent seeing to obtain the sub-arcsecond images necessary for confirmation. A positive result for either or both experiments will mandate a drastic revision of the models for the origin of Pluto and the origin of the asteroids.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, THE CHEMICAL COMPOSITION OF LATE TYPE STARS

G. Wallerstein, University of Washington, School of Arts & Sciences, Dept. of Astronomy, *Seattle, Washington* 98105 (AST79-21005)

The chemical composition of the outer layers of a star can change as material from the deep interior is brought to the surface. In cool giant stars the mixed material has been sufficiently deep to have been subjected to the nuclear reactions associated with the production of the star's energy. These reactions are of three types: the fusion of hydrogen into helium involves reactions with carbon, nitrogen, and oxygen. The analysis of the abundances of the carbon, nitrogen, and oxygen isotopes provides information on the temperature at which fusion took place. Second, the fusion of helium into carbon must have taken place in these cool stars since they show high carbon abundances. Third, there must have been a sequence of neutron captures to produce certain heavy elements which are found in substantial excess in these stars. It is possible to determine which reactions produce the neutrons. Since all of these reactions are probably occurring simultaneously in a shell with a temperature near one hundred million degrees, it will be possible to determine the physical conditions in this shell.

The research will make use of the 4-meter telescopes at Kitt Peak, Arizona and Cerro Tololo, Chile. High dispersion spectra will be taken in the visual and infrared regions. The spectra will resolve individual atomic and molecular lines which will be analyzed using computer models of the stellar atmosphere. These models predict how the strength of the observed lines depends upon the abundance of each element and hence may be combined with the measured line strengths to tell us the abundances.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, HISTORY OF PLANETARY PHYSICS

S.G. Brush, University of Maryland, College Park Campus, Inst. for Physical Science & Technology, *College Park, Maryland* 20742 (SOC77-26749)

Dr. Brush is conducting historical research in the area of nineteenth and twentieth century geophysics and astrophysics, with special emphasis on the connections of these sciences with the so-called 'fundamental' parts of physical science (atomic theory, thermodynamics, electromagnetism, relativity). In addition to publications on the history of planetary physics, he expects that the project will ultimately lead to a book on the history of modern physical science in which the development of planetary physics and its relations to other disciplines are included.

Dr. Brush is currently concentrating on a detailed study of changes in ideas about the early development and internal constitution of the earth since 1830, and on the development of astrophysical, geological and chemical sciences relating to theories of the origin of the solar system in the twentieth century. He is examining aspects such as the impact of discoveries in celestial mechanics, radioactivity, and seismology, reasons for the rejection and later revival of ideas such as nebular origin of the solar system, planetesimal hypothesis, fluid regions inside the earth, and continental drift; and the interactions of scientific dis-

ciplines such as astronomy, physics, geology, chemistry and applied mathematics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Science

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N81-12011*# National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING. A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 127, OCTOBER 1980
Oct. 1980 138 p
(NASA-SP-7037(127)) Avail: NTIS HC $5.00 CSCL 01A

A bibliography containing 431 abstracts addressing various topics in aeronautical engineering is given. The coverage includes engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. M.G.

N81-12012*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT EVALUATION OF THE EFFECT OF WINGLETS ON PERFORMANCE AND HANDLING QUALITIES OF A SINGLE-ENGINE GENERAL AVIATION AIRPLANE
Bruce J. Holmes, Cornelis P. vanDam (Kansas Univ., Lawrence), Philip W. Brown, and Perry L. Deal Dec. 1980 28 p refs
(NASA-TM-81892; L-13960) Avail: NTIS HC A03/MF A01 CSCL 01C

A flight evaluation was conducted to determine the effects of winglets on the performance and handling qualities of a light, single-engine general aviation airplane. The performance measurements were made with a pace airplane to provide calibrated airspeeds; uncalibrated panel instruments in the test airplane were used to provide additional quantitative performance data. These tests were conducted with winglets on and off during the same day to measure relative performance effects. Handling qualities were evaluated by means of pilot comments. Winglets increased cruise speed 8 knots (5.6 percent) at 3962 m (13,000 ft) density altitude and 51 percent maximum continuous power setting. Maximum speed at 3962 m was virtually unchanged. Rate of climb increased approximately 6 percent, or 0.25 m/sec (50 ft/min), at 1524 m (5000 ft). Stall speed was virtually unchanged. Handling qualities were favorably affected. Author

N81-12013# Administrative Sciences Corp., Falls Church, Va.
NAVAL AIRCRAFT OPERATING AND SUPPORT COST-ESTIMATING MODEL: FY78 REVISION
Mar. 1980 82 p
(Contract N00014-77-C-0180)
(AD-A090044; ASC-R-126) Avail: NTIS HC A05/MF A01 CSCL 14/1

This report provides the updated equations using fiscal 1978 data for the Administrative Sciences Corporation Aircraft Operating and Support (O S) Cost-Estimating Model. It is intended to be used as an addendum to Naval Aircraft Operating and Support Cost-Estimating Model - FY77 Revision, ASC-R-120, February 1979, which contains an extensive discussion of each cost element as well as other background material. Several initiatives to improve the quality and accuracy of the cost-estimating relationships were incorporated into this version of the model. The most notable is the examination of Replenishment Spares consumption over a two year period rather than a single year. As more data becomes available, the period will be lengthened even more. Substantial work was also done in the areas of Engine Rework and Modifications. For engines, the recently implemented Engine Analytical Maintenance Plan which has changed the Navy's engine maintenance philosophy for most engines from one of scheduled overhaul to one without scheduled overhaul was investigated. This new policy provides for engine components to be replaced/overhauled periodically but not the entire engine. Although much useful data was obtained on engine removal rates and differentiation of maintenance costs for engines utilized in different aircraft (e.g., the J52-P8 in the A-4E and the A-6E); the data does not yet reflect the new maintenance policy. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N81-12014*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
A COMPUTER PROGRAM TO CALCULATE THE LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF UPPER-SURFACE-BLOWN WING-FLAP CONFIGURATIONS Final Report
Michael R. Mendenhall Washington NASA Aug. 1978 103 p refs
(NASA-CR-3005; NEAR-TR-158) Avail: NTIS HC A06/MF A01 CSCL 01A

A user's manual is presented for a computer program in which a vortex-lattice lifting-surface method is used to model the wing and multiple flaps. The engine wake model consists of a series of closely spaced vortex rings with rectangular cross sections. The jet wake is positioned such that the lower boundary of the jet is tangent to the wing and flap upper surfaces. The two potential flow models are used to calculate the wing-flap loading distribution including the influence of the wakes from up to two engines on the semispan. The method is limited to the condition where the flow and geometry of the configurations are symmetric about the vertical plane containing the wing root chord. The results include total configuration forces and moments, individual lifting-surface load distributions, pressure distributions, flap hinge moments, and flow field calculation at arbitrary field points. The use of the program, preparation of input, the output, program listing, and sample cases are described. A.R.H.

N81-12015*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 13 PERCENT THICK MEDIUM SPEED AIRFOIL DESIGNED FOR GENERAL AVIATION APPLICATIONS
Robert J. McGhee and William D. Beasley Aug. 1979 79 p refs
(NASA-TP-1498; L-12976) Avail: NTIS HC A04/MF A01 CSCL 01A

Wind tunnel tests were conducted to determine the low speed, two dimensional aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications. The results were compared with data for the 13 percent thick low speed airfoil. The tests were conducted over a Mach number range from 0.10 to 0.32, a chord Reynolds number range from 2.0 x 10 to the 6th power to 12.0 x 10 to the 6th power, and an angle of attack frange from about -8 deg to 10 deg. The objective of retaining good high-lift low speed characteristics for an airfoil designed to have good medium speed cruise performance was achieved. S.F.

N81-12016*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.
ASSESSMENT OF VARIABLE CAMBER FOR APPLICATION TO TRANSPORT AIRCRAFT
Nov. 1980 94 p refs
(Contract NAS1-15231)
(NASA-CR-158430) Avail: NTIS HC A05/MF A01 CSCL 01A

The potential benefits were determined for the variable camber of commercial transport airplanes designed for intercontinental and domestic missions. A variable camber concept was developed and incorporated into airplanes designed for the two missions. Benefits were evaluated by comparing the mission performance and direct operating costs for the variable camber airplanes with those for reference airplanes designed for the same missions but having fixed geometry high speed wings. Several technical uncertainties associated with implementing variable camber were also examined. R.C.T.

N81-12017*# Mississippi State Univ., Mississippi State. Dept. of Aerospace Engineering.
ON THE SOLUTION OF THE UNSTEADY NAVIER-STOKES EQUATIONS FOR HYPERSONIC FLOW ABOUT AXIALLY-SYMMETRIC BLUNT BODIES Final Technical Report, May 1978 - Sep. 1980
Z. U. A. Warsi, R. A. Weed, and J. F. Thompson Sep. 1980 49 p refs
(Contract NAS8-32912)
(NASA-CR-161609; MSSU-EIRS-ASE-80-6) Avail: NTIS HC A03/MF A01 CSCL 01A

A formulation of the complete Navier-Stokes problem for a viscous hypersonic flow in general curvilinear coordinates is presented. This formulation is applicable to both the axially symmetric and three dimensional flows past bodies of revolution. The equations for the case of zero angle of attack were solved past a circular cylinder with hemispherical caps by point SOR finite difference approximation. The free stream Mach number and the Reynolds number for the test case are respectively 22.04 and 168883. The whole algorithm is presented in detail along with the preliminary results for pressure, temperature, density and velocity distributions along the stagnation line.
Author

N81-12018*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A CONSERVATIVE IMPLICIT FINITE DIFFERENCE ALGORITHM FOR THE UNSTEADY TRANSONIC FULL POTENTIAL EQUATION
Joseph L. Steger (Flow Simulations, Inc., Sunnyvale, Calif.) and Francis X. Caradonna (Army Aviation Research and Development Command, St. Louis, Mo.) Oct. 1980 40 p refs
(Contract NAS2-10417)
(NASA-TM-81211; AVRADCOM-TR-80-A-14) Avail: NTIS HC A03/MF A01 CSCL 01A

An implicit finite difference procedure is developed to solve the unsteady full potential equation in conservation law form. Computational efficiency is maintained by use of approximate factorization techniques. The numerical algorithm is first order in time and second order in space. A circulation model and difference equations are developed for lifting airfoils in unsteady flow; however, thin airfoil body boundary conditions have been used with stretching functions to simplify the development of the numerical algorithm. Author

N81-12019*# Mississippi State Univ., Mississippi State.
FULL SCALE VISUALIZATION OF THE WING TIP VORTICES GENERATED BY A TYPICAL AGRICULTURAL AIRCRAFT Final Report
Ernest J. Cross, Jr., Philip D. Bridges, Joe A. Brownlee, and W. Wayne Liningston Nov. 1980 103 p refs
(Grant NsG-1511)
(NASA-CR-159382) Avail: NTIS HC A06/MF A01 CSCL 01A

The trajectories of the wing tip vortices of a typical agricultural aircraft were experimentally determined by flight test. A flow visualization method, similar to the vapor screen method used in wind tunnels, was used to obtain trajectory data for a range of flight speeds, airplane configurations, and wing loadings. Detailed measurements of the spanwise surface pressure distribution were made for all test points. Further, a powered 1/8 scale model of the aircraft was designed, built, and used to obtain tip vortex trajectory data under conditions similar to that of the full-scale test. The effects of light wind on the vortices were demonstrated, and the interaction of the flap vortex and the tip vortex was clearly shown in photographs and plotted trajectory data. Author

N81-12020# Air Force Academy, Colo.
B-52 WAKE INVESTIGATION
Wade H. Bailey, Jr. and Thomas A. Durham 10 Mar. 1980 20 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Aircraft in Jan. or Feb. 1981
(LOG-C3932) Avail: NTIS HC A02/MF A01

The wake characteristics of a B-52 in flight are determined. Of specific concern is the fact that variations in the ambient atmosphere introduced by an aircraft wake manifested by increased wind velocities and gas constituents can cause fluctuations in laser beam propagation. By flying a B-52 upwind of a highly instrumented metrological tower, wake vortex wind speeds and gas concentrations of the exhaust were obtained. The test was conducted in crosswinds as high as 80 ft/sec which allowed the inspection of wakes 5 seconds in age and 2000 feet behind the aircraft. In this region, it was found that the vortex contained: (1) wind speeds in excess of 210 ft/sec and (2) a 250 percent increase in the concentrations of CO2. The implication of these results is that propagation of high energy lasers through aircraft wakes could be seriously degraded. M.G.

N81-12021*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL AND THEORETICAL AERODYNAMIC CHARACTERISTICS OF TWO HYPERSONIC CRUISE AIRCRAFT CONCEPTS AT MACH NUMBERS OF 2.96, 3.96, AND 4.63
Jimmy L. Pittman and Gregory D. Riebe Dec. 1980 116 p refs
(NASA-TP-1767; L-13868) Avail: NTIS HC A06/MF A01 CSCL 01A

The longitudinal and lateral directional aerodynamic characteristics for two Mach 5 cruise aircraft concepts were determined for test Mach numbers of 2.96, 3.96, and 4.63. Estimates from hypersonic impact theory and first order supersonic linearized theory were compared with data to indicate the usefulness of these methods. The method which applied tangent cone empirical theory to the body and tangent wedge theory to the wings and to the horizontal and vertical tails provided the best estimates. The tangent cone empirical theory applied to all components showed poor agreement with data, and the linear theory estimates were accurate only for lift coefficient and drag coefficient at low angles of attack. Author

N81-12022*# Kentron International, Inc., Hampton, Va.
INDUCED DRAG IDEAL EFFICIENCY FACTOR OF ARBITRARY LATERAL-VERTICAL WING FORMS
John DeYoung Washington NASA Dec. 1980 50 p refs

(Contract NAS1-16000)
(NASA-CR-3357) Avail: NTIS HC A03/MF A01 CSCL 01A

A relatively simple equation is presented for estimating the induced drag ideal efficiency factor e for arbitrary cross sectional wing forms. This equation is based on eight basic but varied wing configurations which have exact solutions. The e function which relates the basic wings is developed statistically and is a continuous function of configuration geometry. The basic wing configurations include boxwings shaped as a rectangle, ellipse, and diamond; the V-wing; end-plate wing; 90 degree cruciform; circle dumbbell; and biplane. Example applications of the e equations are made to many wing forms such as wings with struts which form partial span rectangle dumbbell wings; bowtie, cruciform, winglet, and fan wings; and multiwings. Derivations are presented in the appendices of exact closed form solutions found of e for the V-wing and 90 degree cruciform wing and for an asymptotic solution for multiwings. Author

N81-12023# Ballistic Systems Div., Norton AFB, Calif.
A COMPARISON OF NAVIER-STOKES COMPUTATIONS WITH EXPERIMENTAL DATA FOR A PROJECTILE SHAPE AT TRANSONIC VELOCITIES
Charles J. Nietubicz and Lyel D. Kayser Jun. 1980 14 p refs
(AD-A090424) Avail: NTIS HC A02/MF A01 CSCL 20/4

A concentrated theoretical and experimental research program has been ongoing at BRL in order to develop the predictive capabilities required for determining projectile aerodynamics. Supersonic computations using combined inviscid flow field and boundary layer techniques have been developed for cone-cylinder and ogive-cylinder configurations. Recent results have been obtained in supersonic flow over a typical boattailed projectile using modern computational techniques for solving the thinlayer Navier-Stokes equations. GRA

N81-12024# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
LOW DRAG AIRFOIL DESIGN UTILIZING PASSIVE LAMINAR FLOW AND COUPLED DIFFUSION CONTROL TECHNIQUES Final Report, 30 Sep. 1977 - 1 Dec. 1979
R. L. Mask Sep. 1980 84 p refs
(Contracts N62269-77-C-0442; N62269-79-C-0277)
(AD-A090778; ATC-R-91100/9CR-71; NADC-79119-60) Avail: NTIS HC A05/MF A01 CSCL 20/4

A two dimensional high chord Reynolds number passive laminar airfoil was designed for a C sub l = 0.73 at a M at infinity = 0.6 and Re sub c = 4 times 10 to the 7th power providing an extremely high L/D = 240. This laminar airfoil design concept integrates passive laminar flow stabilization, by pressure gradient shaping, with active diffusion control techniques on the airfoil trailing edge. A discussion of the airfoil design concept and the predicted performance is presented. Full scale Reynolds number passive laminar flow/transition experiments defining maximum transition Reynolds number and real flow environment influence on transition are presented. Examination of wind tunnel scaling influences and real flow environment effects on the ATC/laminar airfoil performance are discussed and summarized for typical low turbulence tunnels. GRA

N81-12025# Dayton Univ., Ohio.
TRANSONIC FLOW COMPUTATIONS WITH SEPARATE TREATMENT OF THE SUBSONIC AND SUPERSONIC REGIONS Interim Report, Oct. - Dec. 1979
Karl G. Guderley Aug. 1980 42 p refs
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A090327; UDR-TR-80-33; AFWAL-TR-80-3091) Avail: NTIS HC A03/MF A01 CSCL 20/4

The report outlines a method for the computation of transonic flow fields in which one applies a finite element approach to the subsonic region, and the method of characteristic for the supersonic region and matches the two results at the sonic line and at the shock. The equations for the subsonic region can be obtained from Bateman's extremum principle. In each iteration step a preliminary location of the sonic line and of the shock is obtained. A new iteration step computes for this approximation of the sonic line and the given profile contour an exact supersonic flow field, and in addition, still from the supersonic region, the changes which occur in this field at the current sonic line and at the current shock location, if one changes the shape of the sonic line in a systematic manner. GRA

N81-12026# Vought Corp. Advanced Technology Center, Inc., Dallas, Tex.
TURBULENCE MODELING FOR APPLICATION TO V/STOL PROPULSION INDUCED EFFECTS: TWO DIMENSIONAL FORMULATION Final Report, Jan. - Oct. 1979
Andres H. Ybarra 15 Nov. 1979 61 p refs
(Contract N00019-79-C-0136)
(AD-A090331; ATC-R-91000/9CR-66) Avail: NTIS HC A04/MF A01 CSCL 20/4

Feasibility is established for the use of a statistical vortex model of turbulence to characterize shear flows associated with mixing and entrainment. The model is an extension of an approach used successfully for prediction of inlet flow maximum distortion levels. Analytically it forms the closure required for the governing Reynolds and kinetic energy turbulent flow equations. Applicability of the model to shear flows is validated by focusing on fully developed turbulent flow in a two dimensional channel. The solutions completely characterize the flow with a single distributive set of vortex (or eddy) properties. This includes the mean velocity profiles, cross correlation (Reynolds) stress terms, root-mean-square levels of the axial and lateral velocity perturbations, and energy production, diffusion, and dissipation terms. Comparisons with an extensive channel data base verify the characterization. In addition, the solutions provide the framework for coupling the analytics with experimental boundary (or initial) conditions to define scaling relations. The studies indicate that a definite variation in turbulence eddy properties exists across the channel. These variations can be determined from measurements of the flow field unsteady pressure fluctuations. The results are applicable to turbulent flow boundary layers and flow mixing problems in general, and ultimately to aircraft propulsion induced effects (e.g., V/STOL) where jet mixing and entrainment dominate the flight/model scaling and simulation requirements. GRA

N81-12027# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPUTATIONAL PARAMETRIC STUDY OF THE AERODYNAMICS OF SPINNING SLENDER BODIES AT SUPERSONIC SPEEDS
Walter B. Sturek, Donald C. Mylin, and Clarence C. Bush Jun. 1980 15 p refs
(AD-A090443) Avail: NTIS HC A02/MF A01 CSCL 20/4

Recent trends in projectile design have led to shapes with greater length and more slender ogives. Unexpected flight stability problems have been encountered due to decreased aerodynamic stability of these new shapes. Clearly, conventional aerodynamic predictive capabilities were not adequate. In an effort to avoid these problems in the future, the Ballistic Research Laboratory has been developing advanced numerical computational techniques for computing projectile aerodynamic characteristics to improve shell design technology. GRA

N81-12028# Saab-Scania, Goteberg (Sweden).
MULTIGRID TECHNIQUE APPLIED TO LIFTING TRANSONIC FLOW USING FULL POTENTIAL EQUATION
Bert Arlinger 21 Dec. 1978 14 p refs
(SAAB-L-0-1-B439) Avail: NTIS HC A02/MF A01

A multigrid technique in one coordinate direction was applied to a program (SLOR) for solving the full potential equation for the transonic flow around a two-element airfoil configuration. The multigrid technique is based on the convergence rate in ordinary SLOR normally being best for the high frequency error components and worst for the lowest frequency components. Calculation results show substantial improvement in convergence rate as compared to ordinary SLOR. Author (ESA)

N81-12029# Rolls-Royce Ltd., Derby (England).
SYSTEM TO MEASURE THE PRESSURE DISTRIBUTION ON FAN AEROFOIL SURFACES DURING FLUTTER CONDITIONS
John W. H. Chivers 1980 6 p refs
(PNR-90013) Avail: NTIS HC A02/MF A01

High speed flutter tests were conducted on a research fan in which the blade surface pressures were measured by means of miniature silicon diaphragm pressure transducers embedded

in selected fan blades. The effects of centrifugal force and vibration on the transducer performance and a transducer mounting technique was developed to minimize blade induced stress in the transducer. Instantaneous measurements of the tip stagger angles of the pressure instrumented fan blades enabled a cross correlation to be made on the blade surface pressure data and the blade tip angles. Author (ESA)

N81-12030# Centre National de la Recherche Scientifique, Marseilles (France). Inst. de Mecanique des Fluides de Marseille.

EXPERIMENTS ON AN AIRFOIL AT HIGH INCIDENCE IN PLUNGING MOTION

D. Favier, J. Rebont, and C. Maresca Paris Association Aeronautique et Astronautique de France 1980 52 p refs In FRENCH; ENGLISH summary Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-09; ISBN-2-7170-0605-2) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

Dynamic stall, usually studied in the case of the pitching motion, is investigated by means of plunging motion, where the airfoil is forced to oscillate in translation normal to the uniform aistream. Unsteady effects are made clear by a combination of flow visualization, measurements of aerodynamic components, static pressure, and skin friction distributions along the airfoil chord. The results are compared to those already obtained, on pitching airfoils. The effects involved by the two oscillating modes are shown to be quite similar for frequency parameters from 0.10 to 0.15, amplitudes of fluctuating incidence varying from 5 deg to 15 deg, around mean incidences varying from 0 deg to 20 deg. Author (ESA)

N81-12031# Universite des Sciences et Techniques de Lille (France). Inst. de Mecanique des Fluides.

EXPERIMENTAL AND NUMERICAL STUDY OF FLOW IN AIR INTAKES AT HIGH INCIDENCES [ETUDE EXPERIMENTALE ET NUMERIQUE DE L'ECOULEMENT DANS UNE PRISE D'AIR A GRANDE INCIDENCE]

M. Stanislas Paris Association Aeronautique et Astronautique de France 1980 54 p refs In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-19; ISBN-2-7170-0615-X) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

A rectilinear walled two-dimensional model is considered. Low velocity experiments were performed using a double exposure holographic method. A seeding of the flow is required in the nonperturbating velocimetry method employed. In this way, three components of the instantaneous velocity can be acquired in a three dimensional system. An attempt is made to calculate internal turbulent flow from velocity profiles at the air intake.

Author (ESA)

N81-12032# Conservatoire National des Arts et Metiers, Paris (France).

SHEARED THREE DIMENSIONAL FLOW AROUND SURFACE VEHICLES [ECOULEMENTS TRIDIMENSIONNELS DECOLLES AUTOUR DE VEHICULES TERRESTRES]

F. Chometon and P. Fontanet (Regie Natl. des Usines Renault) Association Aeronautique et Astronautique de France 1980 32 p refs In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-23; ISBN-2-7170-0619-2) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

Wind tunnel studies are extended to the three dimensional case and a non-viscous nonstationary schema used. The obstacle is represented by singularities, the wake being simulated by particle vortices emitted from the sheared line. Calculations performed for axially symmetric bodies confirm the evolution of the vortex layer as a function of the bottom plane angle. The two dimensional sheared structure layer observed for a straight bottom changes into a torn structure with lateral cornet shape rolling when the bottom is excessively sloped. Author (ESA)

N81-12033# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

EVALUATION OF LEVINSKY'S METHOD FOR THE CALCULATION OF THE LIFT DISTRIBUTION ON A WING IN PROPULSIVE JETS

T. Zandbergen and R. A. Maarsingh 21 Jan. 1980 49 p refs (Contract NIVR-1068)

(NLR-TR-77104-U) Avail: NTIS HC A03/MF A01

Based on comparison with results from experiments, an evaluation was performed of a method used to calculate the spanwise lift distribution on wings immersed in propulsive jets. Modifications of the original method were investigated. It is found that the method gives satisfactory results for an unflapped wing. However, even at a relatively small flap deflection the jet-induced effects are strongly underrated. The discrepancies can be reduced somewhat by adopting an improved wing model. It is concluded that this approach has a fundamental weakness, which must be input to the rigid jet model. The result is that basic features of the wing jet interaction, such as jet mixing and deformation, cannot be accounted for. Author (ESA)

N81-12034# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

MEASUREMENTS IN A TWO DIMENSIONAL WAKE MERGING INTO A BOUNDARY LAYER

P. J. Pot 22 Jun. 1979 56 p refs

(NLR-TR-79063-U) Avail: NTIS HC A04/MF A01

Extensive measurements of mean and fluctuating quantities in a two dimensional wake shed from flat plate and in the flow field of a two dimensional wake merging into a boundary layer are described. The experiments were carried out in a low speed wind tunnel at a Reynolds number of 2.4 million per meter. Surface static pressure, wake, boundary layer, and merging flow data are presented in tabular and graphic form. Author (ESA)

N81-12035# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Aeroelastik.

UNSTEADY AERODYNAMICS INPUTS FOR AEROELASTIC ANALYSES. PART A: A GENERAL INTRODUCTION. PART B: PREDICTION OF THE UNSTEADY AIRLOADS ON OSCILLATING LIFTING SYSTEMS AND BODIES IN SUBSONIC AND SUPERSONIC FLOW

Wolfgang Geissler Jan. 1980 110 p refs

(DFVLR-Mitt-80-01) Avail: NTIS HC A06/MF A01

The arbitrary time dependent equations of motion in fluid dynamics, serving as starting points for aeroelastic investigations are discussed. The reduction and simplification of these equations to a level more suitable to solution procedures is carried out. A general description of integral and singularity solution methods is given, together with the corresponding boundary conditions. Some of the major prediction methods in unsteady aerodynamics currently in use are discussed in detail. It is shown that the introduction of viscous effects is necessary for future investigations, and that the transonic speed range remains in a low developmental state. Author (ESA)

N81-12036# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

BOUNDARY LAYER MEASUREMENTS ON A TWO DIMENSIONAL WING WITH FLAP AND A COMPARISON WITH CALCULATIONS

B. vandenBerg and B. Oskam 10 Sep. 1979 17 p refs Presented at AGARD Symp. on Turbulence Boundary Layers: Expt., Theory and Modeling, The Hague, 24-25 Sep. 1979

(NLR-MP-79034-U) Avail: NTIS HC A02/MF A01

Measurements were performed on a wing flap configuration, which was so designed that flow separations occur nowhere, apart from a small laminar separation bubble on the wing nose. The measurements comprise surface pressure measurements, boundary layer and wake traverses at 16 stations, and flow visualization tests to establish the presence of separation bubbles and boundary layer transition regions. The data resolve the various flow phenomena sufficiently well to provide a significant test case for calculation methods for the flow around multielement airfoils. Comparison with such a calculation method showed satisfactory agreement. A need for improved modeling was found to exist in some regions, particularly for the wing wake above the flap. Author (ESA)

N81-12037# Royal Aircraft Establishment, Farnborough (England).
THE REYNOLDS NUMBER FOR TRANSITION ON A FLAT PLATE IN THE RAE 4 FT X 3 FT LOW TURBULENCE WIND TUNNEL
K. G. Winter and E. C. Maskell London HMSO May 1980 23 p refs
(RAE-TM-AERO-1854; BR75309) Avail: NTIS HC A02/MF A01

Reynolds numbers for transition on a flat plate measured in the Royal Aircraft Establishment 4 ft X 3 ft tunnel with two different screen arrangements in the settling chamber are presented. In the two series the transition Reynolds number varies in magnitude in opposite senses with tunnel speed but the same trend is indicated for the variation with turbulence level. At the lowest level of turbulence achieved, the transition Reynolds number approaches 6 million, corresponding to a value of n of 13 for the 'E to the nth power' method. Author (ESA)

N81-12038# Royal Aircraft Establishment, Farnborough (England).
THE PREDICTION OF THE BURSTING OF LAMINAR SEPARATION BUBBLES IN THE DESIGN OF TWO DIMENSIONAL HIGH-LIFT AEROFOILS
B. R. Williams London HMSO May 1980 37 p refs
(RAE-TR-80060; RAE-AERO-3479; BR74909) Avail: NTIS HC A03/MF A01

The structure of laminar separation bubbles is described and methods of predicting the bursting of these bubbles on the slat of a high-lift wing are examined. In particular Horton's method is found to give a useful description of the growth and bursting of the bubble. A method of predicting the burst of short bubbles is developed by combining the Crabtree maximum pressure rise parameter with the assumption that the separated turbulent shear layer is an equilibrium flow. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N81-12039*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AIR CARGO MARKET OUTLOOK AND IMPACT VIA THE NASA CLASS PROJECT
Matthew M. Winston and D. William Conner Oct. 1980 22 p refs Presented at the 10th Intern. Forum for Air Cargo, Amsterdam, 30 Sep. - 2 Oct. 1980
(NASA-TM-81886) Avail: NTIS HC A02/MF A01 CSCL 05C

An overview is given of the Cargo/Logistics Airlift Systems Study (CLASS) project which was a 10 man-year effort carried out by two contractor teams, aimed at defining factors impacting future system growth and obtaining market requirements and design guidelines for future air freighters. Growth projection was estimated by two approaches: one, an optimal systems approach with a more efficient and cost effective system considered as being available in 1990; and the other, an evolutionary approach with an econometric behavior model used to predict long term evolution from the present system. Both approaches predict significant growth in demand for international air freighter services and less growth for U.S. domestic services. Economic analysis of air freighter fleet options indicate very strong market appeal of derivative widebody transports in 1990 with little incentive to develop all new dedicated air freighters utilizing the 1990's technology until sometime beyond the year 2000. Advanced air freighters would be economically attractive for a wide range of payload sizes (to 500 metric tons), however, if a government would share in the RD and T costs by virtue of its needs for a slightly modified version of a civil air freighter design (a.g. military airlifter). A.R.H.

N81-12040# Committee on Commerce, Science, and Transportation (U. S. Senate).
AVIATION SAFETY
Washington GPO 1980 168 p Hearings before the Subcomm. on Aviation of the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 25-27 Aug. 1980
(GPO-68-717) Avail: Subcommittee on Aviation

The human factor errors which have caused airline accidents and incidents were reviewed. Human failures represent 80% of the causative factors in aviation accidents. All aspects of airline operations and aircraft safety are discussed. T.M.

N81-12041# Committee on Ways and Means (U. S. House).
COMMUTER AIRPORT SAFETY
Washington GPO 1980 52 p Hearing before Comm. on Ways and Means, 96th Congr., 2d Sess., 13 Feb. 1980
(GPO-60-512) Avail: Subcommittee on Oversight

The hearing before the Subcommittee on Oversight of the Committee on Ways and Means on commuter airport safety is presented. The hearing was on whether the airport and airway trust fund was doing an adequate job of making commuter airports safe. T.M.

N81-12042# National Transportation Safety Board, Washington, D. C.
AEROMEXICO DC-10-30, XA-DUH, OVER LUXEMBOURG, EUROPE Aircraft Incident Report
7 Nov. 1980 34 p
(NTSB-AAR-80-10) Avail: NTIS HC A03/MF A01

About 2138, on November 11, 1979, AEROMEXICO, Flight 945, XA-DUH, a McDonnell-Douglas DC-10-30 aircraft, entered a prestall buffet and a sustained stall over Luxembourg, Europe, at 29,800 ft while climbing to 31,000 ft en route to Miami, Florida, from Frankfurt, German. Stall recovery was effected at 18,900 ft. After recovery, the crew performed an inflight functional check of the aircraft and, after finding that it operated properly, continued to their intended destination. After arrival at Miami, Florida, it was discovered that portions of both outboard elevators and the lower fuselage tail area maintenance access door were missing. There were no injuries to the 311 persons on board Flight 945. No injuries or damage to personnel or property on the ground was reported. Visual meteorological conditions prevailed at the time of the incident. The National Transportation Safety Board determined that the probable cause of this incident was the failure of the flightcrew to follow standard climb procedures and to adequately monitor the aircraft's flight instruments. This resulted in the aircraft entering into a prolonged stall buffet which placed the aircraft outside the design envelope. Author

N81-12043*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A SIMULATOR STUDY FOR THE DEVELOPMENT AND EVALUATION OF OPERATING PROCEDURES ON A SUPERSONIC CRUISE RESEARCH TRANSPORT TO MINIMIZE AIRPORT-COMMUNITY NOISE
William D. Grantham, Paul M. Smith (Kentron International, Inc., Hampton, Va.), and Perry L. Deal Nov. 1980 79 p refs
(NASA-TP-1742; L-13881) Avail: NTIS HC A05/MF A01 CSCL 01C

Piloted-simulator studies were conducted to determine takeoff and landing operating procedures for a supersonic cruise research transport concept that result in predicted noise levels which meet current Federal Aviation Administration (FAA) certification standards. With the use of standard FAA noise certification test procedures, the subject simulated aircraft did not meet the FAA traded-noise-level standards during takeoff and landing. However, with the use of advanced procedures, this aircarft meets the traded-noise-level standards for flight crews with average skills. The advanced takeoff procedures developed involved violating some of the current Federal Aviation Regulations (FAR), but it was not necessary to violate any FAR noise-test conditions during landing approach. Noise contours were also determined for some of the simulated takeoffs and landings in order to indicate the noise-reduction advantages of using operational procedures other than standard. Author

N81-12044# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: ALLEGHENY AIRLINES, INC., NORD 262, MOHAWK/FRAKES 298, N29824, BENEDUM AIRPORT, CLARKSBURG, WEST VIRGINIA, FEBRUARY 12, 1979
16 Aug. 1979 32 p
(NTSB-AAR-79-12) Avail: NTIS HC A03/MF A01

At 1300 e.s.t., on February 12, 1979, a Nord 262, Mohawk/Frakes 298, N29824, operating as Allegheny Flight 561, departed Benedum Airport, Clarksburg, West Virginia, for National Airport, Washington, D.C., with 25 persons on board. The aircraft crashed about 14 sec after liftoff. Two persons were killed and eight persons were seriously injured; the aircraft was destroyed. The official weather at the time of departure was: Sky - partial obscuration, 1,000 ft overcast; visibility - 5/8 mi in snow; wind - calm; altimeter - 29.89 inHg. The National Transportation Safety Board determined that the probable cause of the accident was the captain's decision to take off with snow on the aircraft's wing and empennage surfaces which resulted in a loss of lateral control and a loss of lift as the aircraft ascended out of ground effect. Author

N81-12045# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: NEW YORK AIRWAYS, INC., SIKORSKY S61-L, N618PA NEWARK, NEW JERSEY, APRIL 18, 1979
27 Sep. 1979 39 p
(NTSB-AAR-79-14) Avail: NTIS HC A03/MF A01

About 1823 e.s.t., Flight 972 had just taken off from the airport and was at an altitude of 1,200 ft about 1 mile to the east when one of five blades broke and separated from the tail rotor. Severe vibrations in the tail rotor assembly caused the tail rotor gearbox and rotor assembly to separate from the aircraft when it had descended to about 150 ft above the ground. Without a tail rotor to maintain its stability, the helicopter entered a rapid nosedown, right turn to the ground. Of the 18 persons on board, 3 passengers were killed; 10 passengers and 3 crewmembers were injured seriously. Metallurgical examination revealed that the tail rotor blade failed after a fatigue crack propagated across 90 percent of the blade's leading edge spar and about 2 in. of the blade skin, which weakened the blade structure. The probable cause of this accident was the separation of the tail rotor assembly and gearbox from the aircraft at an altitude which made further controlled flight impossible. The rotor assembly and gearbox separated because of severe vibrations in the rotor assembly which were induced by the loss of a tail rotor blade due to fatigue failure. A.R.H.

N81-12046# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: CHAMPION HOME BUILDERS COMPANY, GATES LEARJET 25B, N999HG, SANFORD, NORTH CAROLINA, SEPTEMBER 8, 1977
20 Sep. 1979 31 p
(NTSB-AAR-79-15) Avail: NTIS HC A03/MF A01

The investigation of the September 8, 1977 crash of a Gates Learjet 25B, N999HG is documented. It is determined that the probable cause of this accident was one or more low order explosions in the aircraft's aft fuselage which resulted in a fire and loss of control capability. The fuel and ignition sources of the initial explosion could not be determined conclusively, however, gases from the aircraft's batteries or fuel leakage from fuel system components, or both, could have been present in the area of the initial explosion. M.G.

N81-12047# Aerospace Corp., El Segundo, Calif.
COMMUTER AIR CARRIER LOAN GUARANTEE STUDY Final Report
F. William Belina Jan. 1980 79 p refs
(Contract DOT-FA79WAI-010)
(AD-A090615; FAA-AVP-80-1) Avail: NTIS HC A05/MF A01 CSCL 05/3

The Airline Deregulation Act of 1978 made commuter air carriers eligible for Government guaranteed loans for the purchase of aircraft. The Federal Aviation Administration is charged with responsibility for administering the program. As an aid to determining commuter eligibility for guarantees and because publicly available financial data on commuters is very limited, it was necessary to assemble information from a number of sources such as the Civil Aeronautics Board, State Aviation Commissions, and interviews with commuter management and loan offers of financial institutions. Data and information are provided concerning (1) purchase price and operating costs of commuter type aircraft (2) current aircraft acquisition practices, typical loan terms and historical financial performance (3) current credit-worthiness standards established by the financial community and (4) financial viability and ability of commuters to meet those standards. GRA

N81-12048# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy.
IFR AIRCRAFT HANDLED FORECAST BY AIR ROUTE TRAFFIC CONTROL CENTER, FISCAL YEARS 1980-1991
Bernard F. Hannan May 1980 109 p
(AD-A090803; FAA-AVP-80-4) Avail: NTIS HC A06/MF A01 CSCL 01/2

The report presents the forecasts of Instrument Flight Rule (IFR) aircraft handled by FAA air route traffic control centers (ARTCC). It serves as a base for the FAA planning and budget process in determining future requirements for facilities, equipment and manpower. The forecasts show that total aircraft handled will increase from 30.1 million in FY 1979 to 44.0 million in FY 1991. These national total numbers along with those for the intervening years are broken down by FAA region and for each air route traffic control center in this report. GRA

N81-12049# SRI International Corp., Menlo Park, Calif. Transportation Center.
AIRPORT AND AIRSPACE DELAY MODEL DESCRIPTION Final Report
John C. Bobick and George J. Couluris Oct. 1979 103 p
(Contract DOT-FA77WA-4033; SRI Proj. 6824)
(AD-A090781; FAA-AVP-79-11) Avail: NTIS HC A06/MF A01 CSCL 01/2

The Airport and Airspace Delay Model (AADM) is a computerized event-step simulation developed to replicate the movement of aircraft through enroute and terminal airspace and runway complexes. The model, which is written in the high-level SIMSCRIPT II.5 programming language, produces output statistics describing aircraft delay and travel time and a log of all simulation events. AADM is designed to model various air traffic conditions including multiple airports, variable route structures and runway use configurations, variable separation rules and control procedures, multiple control sectors, sector capacities, wind conditions, aircraft performance characteristics, variable traffic loadings, and the like. The AADM program logic includes airspace traffic control and airport/airspace interface components. The airspace logic simulates three levels of the operational control process: Level I--tactical control; Level II--sequencing control; and Level III--strategic control. The airport/airspace interface logic simulates final approach, takeoff and landing interleaving and departure control procedures. The multiple airport complex and airspace serving the San Francisco area are used to demonstrate the AADM application. GRA

N81-12050# Dayton Univ., Ohio.
EFFECTS OF BIRD ORIENTATION AT IMPACT ON LOAD PROFILE AND DAMAGE LEVEL Final Technical Report, Feb. - Jul. 1979
Antonios Challita and Blaine S. West Wright-Patterson AFB, Ohio AFWAL Jun. 1980 85 p refs
(Contract F33615-78-C-3402; AF Proj. 2402)
(AD-A090676; UDR-TR-79-63; AFWAL-TR-80-3009) Avail: NTIS HC A05/MF A01 CSCL 19/4

This report describes an experimental study which was conducted to investigate the effects of bird orientation at impact and to identify the worst-case impact. 450 g substitute birds were launched with three different orientations onto 0.635 cm thick polycarbonate panels at four different locations. The minimum perforation velocity was used as the main criterion to measure damage; however, perforation wasn't achieved at the center of the panel and at the lower, or upstream, corner. Therefore, another measure of damage was adopted for these locations; length of cracks, depth of pocket, etc. The end-on, or axial, orientation was found to be the most damaging orientation. Substitute birds

were also launched with the two transverse orientations onto a rigid target plate at three obliquity angles, 90 degrees, 45 degrees, and 25 degrees. Impact pressures were measured, and analyzed. Pressure profiles showed shock pressure only. No steady-state pressures were observed. Shock pressures were compared to theoretical Hugoniot curves and good agreements were obtained. GRA

N81-12051# Peat, Marwick, Mitchell and Co., San Francisco, Calif.
AIRCRAFT TOWING FEASIBILITY STUDY Final Report
Sep. 1980 174 p refs
(Contract DE-AC01-79CS-50069)
(DOE/CS-50069/1) Avail: NTIS HC A08/MF A01

A preliminary assessment of the constraints on and feasibility of extended aircraft towing is provided. Past aircraft towing experience and the state of the art in towing equipment are reviewed. Safety and operational concerns associated with aircraft towing are identified, and the benefits and costs of implementing aircraft towing at 20 major U.S. airports are analyzed. It was concluded that extended aircraft towing is technically feasible and that substantial reductions in aircraft fuel consumption and air pollutant emissions can be achieved through its implementation. It was also concluded that, although capital and operating costs associated with towing would be increased, net savings could generally be attained at these airports. Due to the lack of past experience and the necessity of proving the cost effectiveness of the towing concept, a demonstration of the feasibility of large scale aircraft towing is necessary. The study evaluates the suitability of the 20 study airports as potential demonstration sites and makes recommendations for the first demonstration project. DOE

N81-12052# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Centrale.
TESTS ON THE FIRE RESISTANCE BEHAVIOR OF MATERIALS INSIDE CIVIL AIRCRAFT [LES ESSAIS DE COMPORTEMENT AU FEU DES MATERIAUX D'INTERIEUR D'AVIONS CIVILES]
Andre A. Blavy Paris 22 Apr. 1980 23 p In FRENCH Presented at Assoc. des Amis de l'Ecole Natl. Super. de l'Aeron. et de l'Espace/l'Ecole Natl. Super. des Tech. Avancees Stage de Perfectionnement sur Mater. Aeron. M-01, 22 Jan. 1980
(SNIAS-801-551-101) Avail: NTIS HC A02/MF A01

The equipment employed to perform tests and to identify the gases released from exact replicas of cabin elements is presented. Details are given on the way in which these tests are carried out, the criteria imposed and the results obtained. Author (ESA)

N81-12053# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORTS. BRIEF FORMAT, US CIVIL AVIATION: ISSUE NO. 11, 1979 ACCIDENTS
30 Oct. 1980 171 p
(NTSB-BA-80-8) Avail: NTIS HC A08/MF A01

Selected aircraft accident reports, in brief format, occurring in U.S. civil aviation operations during calendar year 1979 are described. The 299 General Aviation accidents represent a random selection. This publication is issued irregularly, normally fifteen times each year. The brief format presentes the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by injury index, injuries, and causal factors. R.K.G.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N81-12054*# American Electronic Labs., Inc., Lansdale, Pa.
LOW COST AIRBORNE MICROWAVE LANDING SYSTEM RECEIVER, TASK 3 Final Report
James B. Hager and James R. VanCleave Dec. 1979 191 p
(Contract NAS2-9332)
(NASA-CR-152409) Avail: NTIS HC A09/MF A01 CSCL 17G

Work performed on the low cost airborne Microwave Landing System (MLS) receiver is summarized. A detailed description of the prototype low cost MLS receiver is presented. This detail includes block diagrams, schematics, board assembly drawings, photographs of subassemblies, mechanical construction, parts lists, and microprocessor software. Test procedures are described and results are presented. T.M.

N81-12055# Committee on Post Office and Civil Service (U. S. House).
AIR TRAFFIC CONTROLLERS AND FLIGHT SERVICE STATION SPECIALISTS
Washington GPO 1979 263 p refs Hearings on H. R. 1262, H. R. 1781, H. R. 3479 and H. R. 3503 before the Subcomm. on the Civil Serv. of the Comm. on Post Office and Civil Serv., 96th Congr., 1st Sess., 26 and 30 Jun. and 2 and 13 Jul. 1979
(GPO-51-381) Avail: Subcommittee on the Civil Service

The hearings before the House Subcommittee on Civil Service concerning air traffic controllers and flight service station specialists are presented. Legislation dealing with second-career training and early retirement rights is examined. M.G.

N81-12056# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ERROR ANALYSIS OF PURSUIT AND PROPORTIONAL NAVIGATION CONTROL LAWS
Richard DAmato 28 Jan. 1980 45 p refs
(Contract F19628-80-C-0002; AF Proj. 6708)
(AD-A090155; TST-43; ESD-TR-80-68) Avail: NTIS HC A03/MF A01 CSCL 17/7

A comparative study of pursuit and proportional navigation laws to be used in emitter homing simulations is made for several types of flight vehicles. The framework for this study, although relatively simple, includes the essential features of the two control laws, such as the aero/inertial characteristics of the airframe and the important parameters of the autopilot. Both deterministic and stochastic error models of wind, sensor, gyro, and accelerometer are considered. The main conclusions of the study are that gyro bias and sensor noise are dominant for proportional, while wind and sensor bias are most important for pursuit. Proportional was found to be more effective than pursuit, but implementation of proportional with a strapdown sensor may require a more accurate gyro than usually required by an autopilot. GRA

N81-12057# Naval Surface Weapons Center, Dahlgren, Va.
SLBM FIRE CONTROL COMPUTATIONAL ALGORITHMS IN SUPPORT OF STELLAR INERTIAL GUIDANCE
Robert V. Gates and Mark G. Hall 7 Jul. 1980 10 p refs
(AD-A090650) Avail: NTIS HC A02/MF A01 CSCL 17/7

The addition of stellar guidance to a submarine launched ballistic missile (SLBM) system imposes special computational requirements on the fire control system. In general, the stellar guidance algorithms use the observable misorientations of the guidance inertial platform derived from an inflight star sighting and a statistical representation of the weapon system errors to obtain an estimate of the errors in guidance computed state vector (i.e., position, velocity, and inertial platform misorientation). In practice, these errors are estimated by the application of a precomputed gain matrix to the sighting information. The computation of this gain is a fire control responsibility. The improvement in weapon system accuracy achievable through incorporation of this stellar inertial guidance scheme is dependent on the orientation of the guidance inertial platform, i.e., the star to be sighted. An additional fire control task, therefore, is the selection of a star (from a catalog of stars) which enhances the observability of system errors and restricts the propagation of non-observable system errors. The implementation of algorithms

to perform these tasks in a time constrained environment is the subject of this paper. GRA

N81-12058# Army Aviation Research and Development Command, St. Louis, Mo.
LR-80 FLIGHT TEST REPORT Final Report, Aug. 1979 - Feb. 1980
James Maguire and Stanley John Sokolowski, II Sep. 1980 43 p
(AD-A090284; USAAVRADCOM-TR-80-E-2) Avail: NTIS HC A03/MF A01 CSCL 17/7

The report presents and analyzes the flight test results of the LR-80 Attitude and Heading Reference System (AHRS) for the advanced attack helicopter (AAH). GRA

N81-12059# Northrop Corp., Hawthorne, Calif. Electronics Div.
ASTROINERTIAL NAVIGATION FOR CRUISE APPLICATIONS
Robert B. Whitman Sep. 1980 7 p
(AD-A090649) Avail: NTIS HC A02/MF A01 CSCL 17/7

Astroinertial navigation systems provide the greatest accuracy and a bounded position error over an extended use-time and distance. These systems are autonomous, passive, nonjammable and automatic. The key element of the system, the astroinertial instrument, is a three gimbal stable inertial platform with an integral two degree of freedom day-night star tracker that operates automatically world wide. The system provides navigation, guidance, and control with the best accuracy available in any self-contained navigation system, from subsonic through hypersonic speeds. The present operational system described in this paper, NAS-26, provides bounded cruise navigational performance--better than 1,000 ft. CEP--throughout flights of short or long duration (specific performance classified). GRA

N81-12060# Army Armament Research and Development Command, Dover, N. J. Fire Control and Small Caliber Weapon Systems Lab.
EVALUATION OF AN AVAILABLE GYROCOMPASSING LAND NAVIGATOR TO PROVIDE AN ARTILLERY SHOOT AND MOVE CAPABILITY Final Report
Bernard A. Mack, Richard G. Larkin, and Bert P. Pinto Sep. 1980 60 p
(AD-A090733; AD-E400479; ARSCD-MR-80002) Avail: NTIS HC A04/MF A01 CSCL 17/7

Results are documented of a limited test conducted to demonstrate the capability of Gyro Technology to support weapon positioning and pointing requirements to provide a real time shoot and move capability. Such a system eliminates the need to shoot from presurveyed position and, for the first time would allow for the conduct of accurate hasty emplacements, roving guns, dispersed artillery, and so on. A method is presented for providing the Artilleryman with continuously updated Universal Transverse Mercator (UTM) position coordinates. It also provides the capability for laying a weapon on a preferred azimuth in essentially zero time. Following the laying procedure, the existing on carriage fire control (pantel and quadrant) may then be used to lay on subsequent targets. The system used to demonstrate this capability was the Singer Kearfott ANS 2000 land navigator. The evaluation was conducted in both an M109A1 155 mm self-propelled howitzer, and an M113 armored personnel carrier. Results obtained are extremely encouraging and demonstrate the soundness of both the technology and the weapon laying technique. GRA

N81-12061# Army Missile Command, Redstone Arsenal, Ala. Guidance and Control Directorate.
FIELD EVALUATION OF THE ANS-2000 LAND NAVIGATION SYSTEM
L. J. Little Jul. 1980 37 p
(AD-A090793; AD-E950039; DRSMI/RG-80-23-TR) Avail: NTIS HC A03/MF A01 CSCL 17/7

This document contains the results of a field evaluation of the Singer-Kearfott ANS-2000 Land Navigator System performed by the Guidance and Control Directorate at Redstone Arsenal, AL. The overall performance of the system indicates an absolute accuracy of .19% of the distance traveled and a gyrocompassing repeatability of 1 mil. GRA

N81-12062# Army Avionics Research and Development Activity, Fort Monmouth, N. J.
ARMY GPS-DOPPLER HYBRID NAVIGATION SYSTEM
Jack Gray Jun. 1980 15 p refs
(AD-A090394) Avail: NTIS HC A02/MF A01 CSCL 17/7

In accordance with the Department of the Army's approved Positioning and Navigation System (PANS) Materiel Need, the Army's stated objective is to field 'a mix of externally referenced Positioning Subsystems, self-contained subsystems, and hybrid systems to allow for determination of heading, azimuth, and range for navigation and present position'. The intent is to avoid losing completely Pos/Nav/orientation capability for critical missions through dependence by the Army upon any one Nav system in the field. More specifically, the fiscal 1980 Scientific and Technical Objectives Guide defines the need to provide superior accuracy and reliable navigation continuity over the battlefield under all visibility, terrain, and weather conditions for such missions as Aerial Scout Helicopter and Advanced Attack Helicopter. To satisfy these requirements, the Army is developing a family of advanced externally referenced and self-contained Pos/Nav systems and the techniques to hybrid these to satisfy mission requirements at lowest cost. One of these, the Doppler navigator or, ASN-128, is a fully self-contained, EW Secure, sophisticated, dead-reckoning system. However due to residual heading/attitude and velocity errors, its position accuracy degrades as a function of distance traveled. Therefore, mission aircraft which require high accuracy at all times must use a form of position-updated doppler navigator. GRA

N81-12063# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.
SYNOPSIS ON AIRCRAFT INTEGRATED DATA SYSTEMS AND ENGINE HEALTH MONITORING AND MAINTENANCE
Guenter Dahl, Helmut Hardegen, and Wolfgang Hentschel Feb. 1980 240 p refs
(DFVLR-Mitt-80-08) Avail: NTIS HC A11/MF A01; DFVLR, Cologne DM 45,40

Summaries and a comparative survey in tabular form are given of the main points of 304 references on aircraft integrated data systems, engine monitoring, fault detection, and maintenance. Instruments, recording systems, analysis methods, and results are classified by characteristics. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-12064*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
THE EFFECT OF THERMAL STRESSES ON THE INTEGRITY OF THREE BUILT-UP AIRCRAFT STRUCTURES
Jerald M. Jenkins Nov. 1980 60 p refs
(NASA-TM-81352; H-1138) Avail: NTIS HC A04/MF A01 CSCL 01C

A Mach 6 flight was simulated in order to examine heating effects on three frame/skin specimens. The specimens included: a titanium truss frame with a lockalloy skin; a stainless steel z-frame with a lockalloy skin; and a titanium z-frame with a lockalloy skin. Thermal stresses and temperature were measured on these specimens for the purpose of examining their efficiency, performance, and integrity. Measured thermal stresses were examined with respect to material yield strengths, buckling criteria, structural weight, and geometric locations. Principal thermal stresses were studied from the standpoint of uniaxial stress assumptions. Measured thermal stresses were compared to predicted values. R.C.T.

N81-12065*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A MATHEMATICAL MODEL OF THE CH-53 HELICOPTER

William R. Sturgeon and James D. Phillips Nov. 1980 60 p refs
(NASA-TM-81238; A-8345) Avail: NTIS HC A04/MF A01 CSCL 01C

A mathematical model suitable for real time simulation of the CH-53 helicopter is presented. This model, which is based on modified nonlinear classical rotor theory and nonlinear fuselage aerodynamics, will be used to support terminal-area guidance and navigation studies on a fixed-base simulator. Validation is achieved by comparing the model response with that of a similar aircraft and by a qualitative comparison of the handling characteristics made by experienced pilots. Author

N81-12066*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
A MODIFIED T-VALUE METHOD FOR SELECTION OF STRAIN GAGES FOR MEASURING LOADS ON A LOW ASPECT RATIO WING
Ming H. Tang and Robert G. Sheldon Nov. 1980 54 p refs
(NASA-TP-1748; H-1108) Avail: NTIS HC A04/MF A01 CSCL 01C

A technique which may be useful for selecting strain gages for use in load equations is described. The technique is an adaptation of the previously used T-value method and is applied to a multispar structure. The technique, called the modified T-value method, is used to reduce the number of strain gages used in a load equation from twelve to two. A parallel reduction is made by calculating relative equation accuracies from three applied load distributions. The equations developed from the modified T-value method proved to be accurate more consistently than the T-value method. R.K.G.

N81-12067*# Lockheed-California Co., Burbank.
YF-12 COOPERATIVE AIRFRAME/PROPULSION CONTROL SYSTEM PROGRAM, VOLUME 1 Final Report
D. L. Anderson, G. F. Connolly, F. M. Mauro, and P. J. Reukauf 1980 120 p refs
(NASA-CR-163099; SP-5317-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 01C

Several YF-12C airplane analog control systems were converted to a digital system. Included were the air data computer, autopilot, inlet control system, and autothrottle systems. This conversion was performed to allow assessment of digital technology applications to supersonic cruise aircraft. The digital system was composed of a digital computer and a specialized interface unit. A large scale mathematical simulation of the airplane was used for integration testing and software checkout. The system was flown for approximately 23 hours. Author

N81-12068# Aircraft Research and Development Unit, Edinburg (Australia).
PILATUS PORTER: PROVISION OF REVISED TAKE-OFF AND LANDING PERFORMANCE DATA
M. J. Tobin Aug. 1980 19 p refs
(AD-A089964; ARDU-TI-698) Avail: NTIS HC A02/MF A01 CSCL 01/2

The provision of additional take-off and landing data to extend Pilatus Porter flight manual information from the previous gross weight limit of 5700 lb (2585 kg) to the currently authorized limit of 6100 lb (2767 kg) was requested under Technical Investigation No 698. Using ARDU computer facilities, the existing flight manual take-off and landing data were extrapolated to predict performance at the increased weight. Take-off and landing performance was then evaluated during five test periods totalling 5.5 hours in day VMC. Tests were conducted with aircraft gross weight in the range 4380 - 6090 lb (1987 - 2762 kg) using sealed and grassed runways. Aircraft performance was also evaluated with external stores carried on underwing racks. The data generated satisfied both the currently available performance charts and the predicted performance from the extrapolated charts. Carriage of the external stores on the wing racks increased the ground roll by 50% and the distance to climb to 50 ft by 20%. Operation from short dry grass did not significantly affect take-off distances but landing distances were reduced by 20%. Inclusion of the revised charts in the flight manual is recommended. GRA

N81-12069# Rohr Industries, Inc., Chula Vista, Calif.
SONIC FATIGUE DESIGN TECHNIQUES FOR ADVANCED COMPOSITES AIRCRAFT STRUCTURES Final Technical Report, Aug. 1977 - Dec. 1979
Ian Holehouse Apr. 1980 343 p refs
(Contract F33615-77-C-3033)
(AD-A090553; RHR-80-019; AFWAL-TR-80-3019) Avail: NTIS HC A15/MF A01 CSCL 11/4

A combined analytical and experimental program was conducted in order to develop a semi-empirical sonic fatigue design method for curved and flat graphite-epoxy skin-stringer panels. A range of multi-bay panels was subjected to high intensity noise environments in a progressive wave tube. Shaker tests were also performed in order to provide additional random fatigue data. Finite-element analyses were carried out on the test panel designs, generating static strains and frequencies. Multiple stepwise regression analysis was used to develop the sonic fatigue design method. Design equations and a nomograph are presented. Comparisons of sonic fatigue resistance between graphite and aluminum panels were also carried out. The design method developed is presented as a self-contained section in this report and is suitable for practical design use. GRA

N81-12070# Army Materials and Mechanics Research Center, Watertown, Mass.
ACOUSTIC EMISSION AS A NDE TECHNIQUE FOR DETERMINING COMPOSITE ROTOR BLADE RELIABILITY
Richard J. Shuford and William W. Houghton Jun. 1980 15 p refs
(AD-A090440) Avail: NTIS HC A02/MF A01 CSCL 11/4

This paper will discuss the progress made in an ongoing program to investigate the use of acoustic emission (AE) to determine the structural integrity of a composite main rotor blade. The blade is constructed primarily of S glass/epoxy and aramid/epoxy. GRA

N81-12071# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.
STABILITY OF NONUNIFORM ROTOR BLADES IN HOVER USING A MIXED FORMULATION
Wendell B. Stephens, Dewey H. Hodges, John H. Avila (Technology Development of California, Santa Clara), and Ru-Mei Kung (Technology Development of California, Santa Clara) 1980 20 p refs Presented at the 6th European Rotorcraft and Powered Lift Aircraft Forum, Bristol, England, 16-19 Sep. 1980
(AD-A090756) Avail: NTIS HC A02/MF A01 CSCL 01/3

A mixed formulation for calculating static equilibrium and stability eigenvalues of nonuniform rotor blades in hover is presented. The static equilibrium equations are nonlinear and are solved by an accurate and efficient collocation method. The linearized perturbation equations are solved by a one step, second-order integration scheme. The numerical results correlate very well with published results from a nearly identical stability analysis based on a displacement formulation. Slight differences in the results are traced to terms in the equations that relate moments to to derivatives of rotations. With the present ordering scheme, in which terms of the order of squares of rotations are neglected with respect to unity, it is not possible to achieve completely equivalent models based on mixed and displacement formulations. A study of the one step methods reveals that a second order Taylor expansion is necessary to achieve good convergence for nonuniform rotating blades. Numerical results for a hypothetical nonuniform blade, including the nonlinear static equilibrium solution, were obtained with no more effort or computer time than that required for a uniform blade with the present analysis. GRA

N81-12072# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.
STATUS OF IMPROVED AUTOROTATIVE LANDING CAPABILITY RESEARCH
William A. Pleasants, III and G. Thomas White, III Jun. 1980 20 p refs
(AD-A090431) Avail: NTIS HC A02/MF A01 CSCL 01/2

While the frequency of all emergency autorotative landings (i.e., rate per 100,000 flight hours) has decreased over the past several years for Army single-engine fleet helicopters, the percentage of unsuccessful landings resulting from emergency autorotations has remained relatively high. United States Army Safety Center accident statistics reveal that at least 30 percent

of all emergency autorotative landings involving AH-1, UH-1, OH-58, and OH-6A helicopters result in some degree of vehicle damage or personnel injury. These statistics further indicate that the probability of each of these helicopters experiencing at least one emergency autorotation accident during an assumed 10,000-hour service life is as follows: OH-6(94.0%), AH-1(77.5%), OH-58(76.3%), and UH-1(63.3%). Recent design studies and supplementary research of previously documented findings indicate that it is possible to significantly improve helicopter autorotation capability and reduce demands on pilot skill through helicopter rotor energy augmenting concepts. This paper discusses results of current studies as well as an outline for future in-depth research. GRA

N81-12073# Air Force Flight Test Center, Edwards AFB, Calif. USAF Test Pilot School.

FLIGHT TEST HANDBOOK: FLYING QUALITIES THEORY AND FLIGHT TEST TECHNIQUES Final Report

Nov. 1979 1082 p Supersedes AFFTC-TIH-77-1-Vol-1; AFFTC-TIH-77-1-Vol-2

(AD-A090525; AFFTC-TIH-79-2; AFFTC-TIH-77-1-Vol-1; AFFTC-TIH-77-1-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 01/2

This handbook has been compiled by the instructors of the USAF Test Pilot School for use in Flying Qualities portion of the School's course. Most of the material in this handbook has been extracted from several reference books and is oriented towards the test pilot. The flight test techniques and data reduction methods have been developed at the Air Force Flight Test Center, Edwards Air Force Base, California. GRA

N81-12074# Army Research and Technology Labs., Fort Eustis, Va. Structures Lab.

ON THE USE OF ACTIVE HIGHER HARMONIC BLADE PITCH CONTROL FOR HELICOPTER VIBRATION REDUCTION

Charles E. Hammond and John E. Cline Jun. 1980 17 p refs (AD-A090398) Avail: NTIS HC A02/MF A01 CSCL 01/3

Vibration levels have been a problem in helicopters since their inception. The reason for this lies in the method whereby the helicopter generates its lift, namely, the rotor system. As the rotor blades rotate they encounter a continuously changing aerodynamic environment which results in a continuously changing environment which results in a continuously changing aerodynamic loading on the blades. This changing environment is repeated on each revolution of the rotor. Hence, the rotor develops aerodynamic loads which are oscillatory in nature. These oscillatory loads are transferred directly to the helicopter airframe through the mechanical connection of the rotor to the airframe, i.e., the rotor-shaft/transmission attachment. Oscillatory loads are also transmitted to the airframe by impingement of the rotor wake on the upper portion of the airframe, but the mechanically transferred loads are in most cases much more significant than the aerodynamically transferred loads. GRA

N81-12075# Boeing Vertol Co., Philadelphia, Pa.

ADVANCED TRANSMISSION COMPONENTS INVESTIGATION PROGRAM: BEARING AND SEAL DEVELOPMENT Final Report, 28 Jun. 1976 - Dec. 1979

Joseph W. Lenski, Jr. Aug. 1980 288 p refs

(Contract DAAJ02-76-C-0045; DA Proj. 1L1-62209-AH-76) (AD-A090675; D210-11591-1; USAAVRADCOM-TR-80-D-19) Avail: NTIS HC A13/MF A01 CSCL 01/3

The objective of the Advanced Transmission Components Investigation Program was to conduct development testing on selected critical components for a helicopter advanced transmission which could enter engineering development in the 1980-90 timeframe. Under this contract, advanced transmission components have been designed, analyzed, and tested with the aim of reducing drive system weight and cost, increasing reliability, and improving other important attributes. The work reported in this volume includes the evaluation of VASCO-X2 steel as a bearing material, design and test of a ribbed cup tapered roller bearing with integrated inner race and shaft, test of a magnetic seal design, and development of an advanced finite element analysis of complex bearing structure. The aims and objectives of each component development have been formulated and are compared against test results to develop a measure of improvement to be expected when these developments become operational. GRA

N81-12076# British Aerospace Aircraft Group, Weybridge (England).

THE CHANGING SCENE OF STRUCTURAL AIRWORTHINESS

W. G. Heath Paris Association Aeronautique et Astronautique de France 1979 29 p refs Presented at 14th Intern AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979

(AAAF-NT-79-24; ISBN-2-7170-0572-2) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 22 (France and EEC) FF 27 (others)

The state of the art and the development history of aircraft structures reliability design are reviewed, partly as they are mirrored in official requirements, and partly as they are seen by workers in the field. Included are loading and stress calculations, aeroelasticity, dynamic response, the fatigue problem, and the utilization of composite materials are discussed. Author (ESA)

N81-12077# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.

OPTIMAL DESIGN STUDIES ON COMPOSITE WINGS WITH STATIC AND DYNAMIC CONSTRAINTS

V. B. Venkayya, T. Harris, and N. S. Khot Paris Association Aeronautique et Astronautique de France 1979 43 p refs Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979

(AAAF-NT-79-29; ISBN-2-7170-0577-3) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

Design studies on composite lifting surfaces using two computer programs are described. These programs are based on the displacement method of finite element analysis and serve to optimize structures for minimum weight with given strength and gage requirements. The method includes the study of the sensitivity of the flutter speed to change in frequency and the development of the optimation algorithms from frequency considerations. An analysis of failure criteria and optimization at element and play level is also included. A design example is presented. Author (ESA)

N81-12078# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Helicopter Div.

SPACE STRUCTURE TODAY AND TOMORROW

M. Brunsch Paris Association Aeronautique et Astronautique de France 1979 13 p

(AAAF-NT-79-46; ISBN-2-7170-0594-3) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 22 (France and EEC) FF 27 (others)

The cost effectiveness of carbon fiber composites for aerospace structures is analyzed. Strength to volume ratio, satellite launching cost per unit weight, raw to finished material ratio, evaluation of material properties in space environment, advantage of a low expansion coefficient, and advantages for space construction are discused. It is concluded that carbon fiber composites present both technological advantages and cost effectiveness. Two examples of applications to aircraft structures are described. Author (ESA)

N81-12079# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Direction des Etudes.

SYNTHESIS OF TEST RESULTS OBTAINED WITH CONCORDE AT HIGH INCIDENCES [SYNTHESE DE RESULTATS D'ESSAIS DU CONCORDE A GRANDES INCIDENCES]

D. Collard Paris Association Aeronautique et Astronautique de France 1980 14 p In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-26; ISBN-2-7170-0622-2) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 25 (France and EEC) FF 30 (others)

The lift experienced by Concorde continues to increase uniformly up to an angle of incidence of thirty five degrees. A change in flow characteristics over the airfoil occurs at an angle of twenty two degrees. The consequences of this phenomenon on the aircraft's flight behavior are studied. Most of the results were obtained in wind tunnel experiments with series aircraft

models. Comparisons are also made between some in flight and wind tunnel test results. It is concluded that relatively minor changes in the shape of the airfoil can have extremely important effects on aircraft flight behavior. Author (ESA)

N81-12080# European Space Agency, Paris (France).
INVESTIGATION OF LANDING FLARE IN THE PRESENCE OF WIND SHEAR
Knut Wilhelm and Martin Marchand Jun. 1980 51 p refs Transl. into ENGLISH of "Ein Beitrag zur Berechnung des Abfangvorgangs beim Auftreten von Schewind", Rept. DFVLR-FB-79-20, DFVLR, Brunswick Jun. 1979 Original report in GERMAN previously announced as X80-74199 Original German report available from DFVLR, Cologne DM 11,50
(ESA-TT-631; DFVLR-FB-79-20) Avail: NTIS HC A04/MF A01

A method is presented, which describes the flight path in analytical form with respect to the flare maneuver of the pilot and the wind shear, occuring during the landing flare. The equations of motion were transposed in such a way that systematic treatment of the problem areas was possible. Examples of this approach are given for conventional and short takeoff type landing flare of a large transport aircraft. The influence of coupled control (direct lift control) is shown. It was found that: maintenance of a control function selected by the pilot leads to a reduction in the decay of flight path angle when wind velocity decreases; to achieve touchdown conditions comparable to the undisturbed case, the pilot must vary his control function; a comparison with flight tests shows that a flare path in the form of a fourth order parabola realistically reproduces the actual conditions; and the control function to achieve this flare path can contain a progressive component in addition to the linear increase in pitch attitude. Author (ESA)

N81-12081# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
DEVELOPMENTS IN AIRCRAFT STRUCTURAL MATERIALS
R. J. H. Wanhill, W. G. J. T. Hart, and W. vanderHoeven Sep. 1979 22 p refs In DUTCH; ENGLISH summary Submitted for publication
(NLR-MP-79042-U) Avail: NTIS HC A02/MF A01

An overview of recent and ongoing development in aircraft structural materials is given. In view of current and predicted usage the most important developments concern aluminum alloys and advanced composites. Developments in titanum alloys, high strength steels and adhesive bonding are also discussed. Author (ESA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-12082 Rolls-Royce Ltd., Derby (England).
THE DESIGN DEVELOPMENT AND OPERATION OF GAS TURBINE RADIO TELEMETRY SYSTEMS
J. G. B. Worthy 31 Jan. 1980 9 p refs Presented at ASME 25th Ann. Intern. Gas Turbine Conf., Mar. 1980
(EIR-00733) Avail: NTIS HC A02

Measurements made on the rotating components of aero gas turbines are discussed. Radio telemetry systems designed and manufactured with that purpose are reviewed. A summary of operating experience is presented , which includes the problems encountered and the measures taken to overcome them. Author (ESA)

N81-12083 Rolls-Royce Ltd., Bristol (England). Aero Engine Div.
AN ATTEMPT TO MINIMIZE SECONDARY FLOW EFFECTS IN A TURBINE
A. G. MacDonald 1980 24 p
(PNR-90020) Avail: NTIS HC A02

The problems introduced by blade aspect ratio reduction and the consequent flow blockage increase were examined in relation to the increasing difficulties in cooling blades as they get smaller. It is shown that by designing for radially varying loss, and manipulating the available degrees of freedom in choosing gas angle distribution some degree of control and reduction of secondary losses can be achieved. A redesign example is described by which an efficiency improvement of 2% to 3% was obtained. Author (ESA)

N81-12084*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LOW-SPEED AERODYNAMIC PERFORMANCE OF 50.8 CENTIMETER-DIAMETER NOISE-SUPPRESSING INLETS FOR THE QUIET, CLEAN, SHORT-HAUL EXPERIMENTAL ENGINE (QCSEE)
John M. Abbott, James H. Diedrich, and Robert C. Williams Aug. 1978 37 p refs
(NASA-TP-1178; E-9542) Avail: NTIS HC A03/MF A01 CSCL 21E

Two basic inlet concepts, a high throat Mach number (0.79) design and a low throat Mach number (0.60) design, were tested with four diffuser acoustical treatment designs that had face sheet porosity ranging from 0 to 24 percent for the high Mach number inlet and 0 to 28 percent for the low Mach number inlet. The tests were conducted in a low speed wind tunnel at free stream velocities of 0, 41, and 62 m/sec and angles of attack to 50 deg. Inlet throat Mach number was varied about the design value. Increasing the inlet diffuser face sheet porosity resulted in an increase in total pressure loss in the boundary layer for both the high and low Mach number inlet designs, however, the overall effect on inlet total pressure recovery of 0.991 at the design throat Mach number, a free stream velocity of 41 m/sec, and an angle of attack of 50 deg; inlet flow separation at an angle of attack of 50 deg was encountered with only one inlet configuration the high Mach number design with the highest diffuser face sheet porosity (24 percent). A.R.H.

N81-12085*# General Electric Co., Evendale, Ohio. Aircraft Engine Business Group.
ENGINE DIAGNOSTICS PROGRAM: CF6-50 ENGINE PERFORMANCE DETERIORATION
Ray H. Wulf Nov. 1980 208 p refs
(Contract NAS3-20631)
(NASA-CR-159867) Avail: NTIS HC A10/MF A01 CSCL 21E

Cockpit cruise recordings and test cell data in conjunction with hardware inspection results from airline overhaul shops were analyzed to define the extent and magnitude of performance deterioration of the General Electric CF6-50 high bypass turbofan engine. The magnitude of short term deterioration was isolated from the long term, and the individual damage mechanisms that were the cause for the majority of the performance deterioration was identified. It was determined that the long term engine performance deterioration characteristics were different for the 3 aircraft types currently powered by the CF6-50 engine, but these differences were due to operational considerations (flight length and takeoff derate) and not to differences associated with the aircraft type. Unrestored losses, that is, performance deterioration which remains after engine refurbishment, represents over 70 percent of the total performance deterioration at engine shop visit. Superficial damage, such as, increased surface

roughness, leading edge shape changes on airfoils, and increases in the average clearances between rotating and stationary components is the major contributor to these losses. Seventy one percent of the unrestored losses are cost effective to restore, and if implemented could reduce fuel consumed by CF6-50 engines by 26 million gallons in 1980. R.C.T.

N81-12086*# General Electric Co., Cincinnati, Ohio.
CORE COMPRESSOR EXIT STAGE STUDY. VOLUME 3: DATA AND PERFORMANCE REPORT FOR SCREENING TEST CONFIGURATIONS
D. C. Wisler Nov. 1980 53 p refs
(Contract NAS3-20070)
(NASA-CR-159499; R80AEG313-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 21E

Rear stage blading designs that have lower losses in their endwall boundary layer regions were developed. Test data and performance results for rotor B, stator B, and stator C - blading designs that offer promise of reducing endwall losses relative to the baseline are given. A low speed research compressor was the principal investigative tool. The tests were conducted using four identical stages of blading so that the test data would be obtained in a true multistage environment. S.F.

N81-12087*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
ROTOR REDESIGN FOR A HIGHLY LOADED 1800 FT/SEC TIP SPEED FAN, 2 Final Report
C. R. Bolt Dec. 1980 185 p refs
(Contract NAS3-20591)
(NASA-CR-159879; PWA-5523-92) Avail: NTIS HC A09/MF A01 CSCL 21E

Tests were conducted on a 0.5 hub/tip ratio single-stage fan designed to produce a pressure ratio of 2.280 at an efficiency of 83.8 percent with a rotor tip speed of 548.6 m/sec (1800 ft/sec). The rotor was designed utilizing a quasi three dimensional design system and four-part, multiple-circular-arc airfoil sections. The rotor is the third in a series of single-stage fans that have included a precompression airfoil design and a multiple-circular-arc airfoil design. The stage achieved a peak efficiency of 82.8 percent after performance had deteriorated by 0.6 of a point. The design mass flow was achieved at the peak efficiency point, and the stage total pressure ratio was 2.20, which is lower than the design goal of 2.28. The surge margin of 13% from the peak efficiency point exceeded the design goal of 7%. Author

N81-12088*# AiResearch Mfg. Co., Phoenix, Ariz.
LOW-COST DIRECTIONALLY-SOLIDIFIED TURBINE BLADES, VOLUME 2
R. E. Dennis, G. S. Hoppin, III, and L. G. Hurst Apr. 1979 41 p
(Contract NAS3-20073)
(NASA-CR-159562; AiResearch-21-2953-2-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 21E

An endothermically heated technology was used to manufacture low cost, directionally solidified, uncooled nickel-alloy blades for the TFE731-3 turbofan engine. The MAR-M 247 and MER-M 100+Hf blades were finish processed through heat treatment, machining, and coating operations prior to 150 hour engine tests consisting of the following sequences: (1) 50 hours of simulated cruise cycling (high fatigue evaluation); (2) 50 hours at the maximum continuous power rating (stress rupture endurance (low cycle fatigue). None of the blades visually showed any detrimental effects from the test. This was verified by post test metallurgical evaluation. The specific fuel consumption was reduced by 2.4% with the uncooled blades. A.R.H.

N81-12089*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF HOLE GEOMETRY AND ELECTRIC-DISCHARGE MACHINING (EDM) ON AIRFLOW RATES THROUGH SMALL DIAMETER HOLES IN TURBINE BLADE MATERIAL
Steven A. Hippensteele and Reeves P. Cochran Nov. 1980 14 p
(NASA-TP-1716; E-417) Avail: NTIS HC A02/MF A01 CSCL 21E

The effects of two design parameters, electrode diameter and hole angle, and two machine parameters, electrode current and current-on time, on air flow rates through small-diameter (0.257 to 0.462 mm) electric-discharge-machined holes were measured. The holes were machined individually in rows of 14 each through 1.6 mm thick IN-100 strips. The data showed linear increase in air flow rate with increases in electrode cross sectional area and current-on time and little change with changes in hole angle and electrode current. The average flow-rate deviation (from the mean flow rate for a given row) decreased linearly with electrode diameter and increased with hole angle. Burn time and finished hole diameter were also measured. Author

N81-12090*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION CONTROLS, 1979
Oct. 1980 147 p refs Proc. of symp. held in Cleveland, 17-19 May 1979
(NASA-CP-2137; E-477) Avail: NTIS HC A07/MF A01 CSCL 21E

The state of the art of multivariable engine control is examined in order to determine future needs and problem areas and to establish the appropriate roles of government, industries, and universities in addressing these problems. For individual titles, see N81-12091 through N81-12104.

N81-12091*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MULTIVARIABLE IDENTIFICATION USING CENTRALIZED FIXED MODES
Walter C. Merrill *In its* Propulsion Controls, 1979 Oct. 1980 p 3-10 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

A procedure to determine a state space model of a multivariable system (lambda inputs, m outputs) is presented. The model is suitable for control studies and uses single input, single output (SISO) system data in the identification procedure. The procedure can be defined in three distinct steps. First, the system's lambda x m SISO transfer functions are identified by using any standard or known identification technique for SISO systems. One objective of this step is to identify SISO transfer functions with as few distinct modes as possible between any two functions. Second, the time domain realization of each SISO transfer function is obtained in a straightforward manner and combined into a total multivariable realization. This total realization, in all probability, has more state variables than are required to define system response. In the third step, these excess or redundant states are removed by using minimal realization theory. The remaining states are related to system centralized fixed modes. Eigenvalue-eigenvector techniques were recently reported that yield a computationally feasible solution to the problem posed in step three. The procedure is applied to QCSEE data to demonstrate its feasibility. Author

N81-12092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE SEEKING CONTROLS
Kurt Seldner *In its* Propulsion Controls, 1979 Oct. 1980 p 11-17 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

A performance logic algorithm (PSL) was developed to optimize the performance of propulsion systems for component and sensor degradations by monitoring the performance of the engine system and minimizing thrust specific fuel consumption (TSFC) while retaining a constant engine net thrust. Engine constraints such as surge margin, speed, pressure, and temperature are observed. The PSL algorithm was applied to the quiet, clean, short haul experimental engine. Engine control set points were modified for component degradations in order to restore the nominal net thrust. Results show convergence to the optimum value can be obtained within 60 to 90 seconds, which makes the program acceptable to on line operation with present state of the art minicomputers. Tests indicate that in most cases the PSL algorithm offers some improvement in thrust specific fuel consumption over the manual throttle. A.R.H.

N81-12093*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

F100 MULTIVARIABLE CONTROL SYNTHESIS PROGRAM: A REVIEW OF FULL SCALE ENGINE ALTITUDE TESTS
Bruce Lehtinen and James F. Soeder *In its* Propulsion Controls, 1979 Oct. 1980 p 20-34 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

The benefits of linear quadratic regulator synthesis methods in designing a multivariable engine control capable of operating an engine throughout its flight envelope were demonstrated. The entire multivariable control synthesis program is reviewed with particular emphasis on engine tests conducted in the NASA Lewis propulsion systems laboratory altitude facility. The multivariable control has basically a proportional plus integral, model following structure with gains scheduled as functions of flight condition. The multivariable control logic design is described, along with control computer implementation aspects. Altitude tests demonstrated that the multivariable control logic could control an engine over a wide range of test conditions. Representative transient responses are presented to demonstrate engine behavior and the functioning of the control logic. A.R.H.

N81-12094*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
DESIGN OF A MULTIVARIABLE INTEGRATED CONTROL FOR A SUPERSONIC PROPULSION SYSTEM
Edward C. Beattie *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 35-47 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

An inlet/engine/nozzle integrated control mode for the propulsion system of an advanced supersonic commercial aircraft was studied. Results show that integration of these control functions can result in both operational and performance benefits for the propulsion system. For example, this integrated control mode may make it possible to minimize the use of inlet bypass doors for shock position control. This may be of benefit to the aircraft as a result of minimizing: (1) bypass bleed drag effects; (2) perturbations to the aircraft resulting from the side thrust effect of the bypass bleeds; and (3) potential unstarts of the inlet. A conceptual integrated control mode was developed which makes use of many cross coupling paths between inlet and engine control variables and inlet and engine sensed variables. A multivariable control design technique based upon linear quadratic regulator theory was applied to designing the feedback gains for this control to allow a simulation evaluation of the benefits of the integrated control mode. Author

N81-12095*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Government Products Div.
PROPULSION CONTROLS
Ronald D. Harkney *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 49-59 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

Increased system requirements and functional integration with the aircraft have placed an increased demand on control system capability and reliability. To provide these at an affordable cost and weight and because of the rapid advances in electronic technology, hydromechanical systems are being phased out in favor of digital electronic systems. The transition is expected to be orderly from electronic trimming of hydromechanical controls to full authority digital electronic control. Future propulsion system controls will be highly reliable full authority digital electronic with selected component and circuit redundancy to provide the required safety and reliability. Redundancy may include a complete backup control of a different technology for single engine applications. The propulsion control will be required to communicate rapidly with the various flight and fire control avionics as part of an integrated control concept. A.R.H.

N81-12096*# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
FUTURE AIR FORCE AIRCRAFT PROPULSION CONTROL SYSTEMS: THE EXTENDED SUMMARY PAPER
Charles A. Skira *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 63-67 (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

Hydromechanical control technology simply cannot compete against the performance benefits offered by electronics. Future military aircraft propulsion control systems will be full authority, digital electronic, microprocessor base systems. Anticipating the day when microprocessor technology will permit the integration and management of aircraft flight control, fire control and propulsion control systems, the Air Force Aero Propulsion Laboratory is developing control logic algorithms for a real time, adaptive control and diagnostic information system. A.R.H.

N81-12097*# Boeing Military Airplane Development, Seattle, Wash.
SHOULD WE ATTEMPT GLOBAL (INLET ENGINE AIRFRAME) CONTROL DESIGN?
Christopher M. Carlin *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 71-82 (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

The feasibility of multivariable design of the entire airplane control system is briefly addressed. An intermediate step in that direction is to design a control for an inlet engine augmentor system by using multivariable techniques. The supersonic cruise large scale inlet research program is described which will provide an opportunity to develop, integrate, and wind tunnel test a control for a mixed compression inlet and variable cycle engine. The integrated propulsion airframe control program is also discussed which will introduce the problem of implementing MVC within a distributed processing avionics architecture, requiring real time decomposition of the global design into independent modules in response to hardware communication failures. M.G.

N81-12098*# Detroit Diesel Allison, Indianapolis, Ind.
ROAD MAP TO ADAPTIVE OPTIMAL CONTROL
Robert Boyer *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 83-87 (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

A building block control structure leading toward adaptive, optimal control for jet engines is developed. This approach simplifies the addition of new features and allows for easier checkout of the control by providing a baseline system for comparison. Also, it is possible to eliminate certain features that do not have payoff by being selective in the addition of new building blocks to be added to the baseline system. The minimum risk approach specifically addresses the need for active identification of the plant to be controlled in real time and real time optimization of the control for the identified plant. M.G.

N81-12099*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION CONTROL AND CONTROL THEORY: A NEW RESEARCH FOCUS
John R. Zeller *In its* Propulsion Controls, 1979 Oct. 1980 p 89-95 (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

Technological developments necessary for the implementation of advanced digital control concepts for aircraft propulsion are identified and discussed. Developments associated with the replacement analog controllers with digital control systems, sensors and actuators, and control modes and software are reported. M.G.

N81-12100*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
ENGINE IDENTIFICATION FOR ADAPTIVE CONTROL
Robert G. Leonard and Eric M. Arnett *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 97-104 refs (For primary document see N81-12090 03-07)
(Grant NsG-3119)
Avail: NTIS HC A07/MF A01 CSCL 21E

An attempt to obtain a dynamic model for a turbofan gas turbine engine for the purpose of adaptive control is described. The requirements for adaptive control indicate that a dynamic model should be identified from data sampled during engine operation. The dynamic model identified was of the form of linear differential equations with time varying coefficients. A turbine engine is, however, a highly nonlinear system, so the

identified model would be valid only over a small area near the operating point, thus requiring frequent updating of the coefficients in the model. Therefore it is necessary that the identifier use only recent information to perform its function. The identifier selected minimized the square of the equation errors. Known linear systems were used to test the characteristics of the identifier. It was found that the performance was dependent on the number of data points used in the computations and upon the time interval over which the data points were obtained. Preliminary results using an engine deck for the quiet, clean, shorthaul experimental engine indicate that the identified model predicts the engine motion well when there is sufficient dynamic information, that is when the engine is in transient operation.
M.G.

N81-12101*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
MULTIVARIABLE NYQUIST ARRAY METHOD WITH APPLICATION TO TURBOFAN ENGINE CONTROL
Gary G. Leininger *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 105-110 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

Extensions to the multivariable Nyquist array (MNA) method are used to design a feedback control system for the quiet clean shorthaul experimental engine. The results of this design are compared with those obtained from the deployment of an alternate control system design on a full scale nonlinear, real time digital simulation. The results clearly demonstrate the utility of the MNA synthesis procedures for highly nonlinear sophisticated design applications.
M.G.

N81-12102*# Bendix Corp., Detroit, Mich. Energy Control Div.
MULTIVARIABLE SYNTHESIS WITH TRANSFER FUNCTIONS
Joseph L. Peczkowski *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 111-127 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

A transfer function design theory for multivariable control synthesis is highlighted. The use of unique transfer function matrices and two simple, basic relationships - a synthesis equation and a design equation - are presented and illustrated. This multivariable transfer function approach provides the designer with a capability to specify directly desired dynamic relationships between command variables and controlled or response variables. At the same time, insight and influence over response, simplifications, and internal stability is afforded by the method. A general, comprehensive multivariable synthesis capability is indicated including nonminmum phase and unstable plants. Gas turbine engine examples are used to illustrate the ideas and method.
M.G.

N81-12103*# Notre Dame Univ., Ind.
ALTERNATIVES FOR JET ENGINE CONTROL
Michael K. Sain and R. Michael Schafer *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 129-138 refs (For primary document see N81-12090 03-07) (Grant NsG-3048)
Avail: NTIS HC A07/MF A01 CSCL 21E

Alternatives to linear quadratic regulator theory in the linear case are examined along with nonlinear modelling and optimization approaches for global control. Context for the studies has been set by the DYNGEN digital simulator and by models generated for various phases of the F100 Multivariable Control Synthesis Program. With respect to the linear alternatives, the multivariable frequency domain is stressed. Progress is reported in both the direct algebraic approach to exact model matching, by means of stimulating work on the basic computational issues, and in the indirect generalized Nyquist approach. With respect to nonlinear modelling and optimization, the emphasis is twofold: the development of analytical nonlinear models of the jet engine and the use of these models in conjunction with techniques of mathematical programming in order to study global control over nonincremental portions of the flight envelope. The possibility of using tensor methods is explored.
M.G.

N81-12104*# Toledo Univ., Ohio.
SENSOR/ACTUATOR FAILURE DETECTION FOR TURBOFAN ENGINES
Khosrow Behbehani and Gary G. Leininger (Purdue Univ., Lafayette, Ind.) *In* NASA. Lewis Research Center Propulsion Controls, 1979 Oct. 1980 p 139-143 refs (For primary document see N81-12090 03-07)
Avail: NTIS HC A07/MF A01 CSCL 21E

A procedure for sensor/actuator failure detection using a generalized likelihood ratio (GLR) test is described. The GLR concept can provide a reliable evaluation of failure occurence when associated with a feedback control design which does not require sensor outputs to provide data estimates. A GLR detector was developed and tested.
M.G.

N81-12105*# Cincinnati Univ., Ohio.
EFFECT OF AMBIENT CONDITIONS ON THE EMISSIONS FROM A GAS TURBINE COMBUSTOR Final Report
C. W. Kauffman Washington NASA Nov. 1980 105 p refs (Grant NsG-3045)
(NASA-CR-3355) Avail: NTIS HC A06/MF A01 CSCL 21E

The effect of variations in the ambient conditions of pressure, temperature, and relative humidity upon the emissions of a gas turbine combustion are investigated. A single combustor can from a Pratt and Whitney JT8D-17 engine was run at parametric inlet conditions bracketing the actual engine idle conditions. Data were correlated to determine the functional relationships between the emissions and ambient conditions. Mathematical modelling was used to determine the mechanism for the carbon monoxide and hydrocarbon emissions. Carbon monoxide emissions were modelled using finite rate chemical kinetics in a plug flow scheme. Hydrocarbon emissions were modelled by a vaporization scheme throughout the combustor.
M.G.

N81-12106# Atlantic Research Corp., Gainesville, Va.
EFFECTS OF ADVANCES IN PROPULSION TECHNOLOGY ON MISSILE EFFECTIVENESS
C. R. Limage and J. L. Fields 5 Sep. 1980 26 p
(AD-A090645) Avail: NTIS HC A03/MF A01 CSCL 21/5

This paper presents the effects of propulsion technology evolution on the performance capability of advanced missile systems. The evolution of the missile propulsion system from rocket to ramjet with increased emphasis on advanced airbreathing missile cycles, has significantly extended missile operational capabilities. The development of these new areas of ramjet technology, specifically in solid fuel propellants, offers the advantages of large increases in heating value, density, burning efficiency and improves system packaging. Application of these technology advancements to potential mission scenarios produces impressive increases in overall mission performance. These large performances gains provide a basis for improvements in mission effectiveness in terms of kill probability and survivability. Kill probability is increased by application of shorter intercept times, improved multi-shot capability and reductions in individual system size to improve weapon carrier payload capability. Survivability is enhanced by increased standoff distances and higher penetration velocities. Demonstration of these improved capabilities, over a variety of tactical mission are provided by a direct comparison of missile performance for a variety of missile propulsion systems. The systems studied range from the conventional solid rocket system to the advanced highly energetic boron solid fuel ramjet concept.
GRA

N81-12107# Texas Technological Univ., Lubbock. Dept. of Mechanical Engineering.
NUMERICAL ANALYSIS OF THE FLOW IN THE CONNECTING PASSAGE BETWEEN THE FAN SECTION AND HIGH PRESSURE SECTION OF A TURBOJET ENGINE Final Report
Allen Goldman Jun. 1980 88 p refs
(Grant AF-AFOSR-3561-78; AF Proj. 2307)
(AD-A090506; AFOSR-80-0755TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The flow field in a bifurcated channel was calculated using finite difference techniques which incorporated a body fitted coordinate system. The flow model used was incompressible and could be axisymmetric or two dimensional and laminar or

turbulent flow. The objective was to calculate the flow field for a Reynolds number of 750,000. It was found that the results obtained from the axisymmetric formulation were different from the two dimensional formulation. Since the actual flow geometry is axisymmetric this means that only the axisymmetric formulation should be used in further investigations. The maximum velocity in the channel was 1.7 times the inlet velocity which corresponds to a Mach number of greater than .5. Therefore, the flow is compressible and further investigations should incorporate this fact. GRA

N81-12108# General Motors Corp., Indianapolis, Ind. Diesel Allison Div.
THE EFFECTS OF SOLIDITY, INTERBLADE PHASE ANGLE AND REDUCED FREQUENCY ON THE TIME-VARIANT AERODYNAMIC RESPONSE OF A COMPRESSOR STATOR
Annual Report, 1 May 1979 - 1 May 1980
Robert L. Jay and William A. Bennett Jun. 1980 196 p refs (Contract F49620-78-C-0070; AF Proj. 2307)
(AD-A090546; DDA-EDR-10339; AFOSR-80-1041TR) Avail: NTIS HC A09/MF A01 CSCL 21/5

An experimental investigation was conducted to provide basic unsteady pressure distributions on a stationary vane row, with the primary source of excitation being the wakes generated from an upstream rotor. This was accomplished over a wide range of key parameters in a large-scale, low-speed, single stage compressor. The excitation, the velocity defect created by the rotor blade wakes, was measured with a crossed hot wire. The resulting time-variant aerodynamic response was measured by means of flush mounted high response pressure transducers mounted on a stator vane over a wide range in incidence angles. The dynamic data were analyzed to determine the chordwise distribution of the dimensionless dynamic pressure coefficient and aerodynamic phase lag as referenced to the transverse gust at the vane leading edge. GRA

N81-12980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA RESEARCH IN AEROPROPULSION
Warner L. Stewart *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 11-26 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 21E

N81-12994# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
PROBLEM IN THE MEASUREMENT OF METAL TEMPERATURE, GAS TEMPERATURE, HEAT FLUX AND STRAIN IN COMBUSTORS AND TURBINES
W. G. Alwang *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 9 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-12995# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
TECHNICAL SUPPOSITIONS DEVELOPED FOR SMOKE MEASUREMENTS DURING HIGH PRESSURE FULL ANNULAR COMBUSTOR TESTS AND ENGINE TRIALS
G. Kappler, J. Seyboth, and G. Huster *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-12996# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).
STUDYING THE EXHAUST GAS FROM A POST COMBUSTION TURBOJET ENGINE [ETUDE DES GAZ DECHAPPEMENT DUN TURBOREACTERUR EN RECHAUFFE]
Ph. Gastebois and S. Ropars *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p In FRENCH Prepared in cooperation with Centre d'Essaisdes Propulseurs, Saclay, France (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-12998# Kraftwerk Union A.G., Mulheim (West Germany).
APPLICATION OF MODEL LAWS WHEN DETERMINING THE HEAT TRANSFER COEFFICIENTS BY EXPERIMENTS ON COOLED TURBINE BLADES
O. A. vonSchwerdtner and H.-G. Hosenfeld *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-12999# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
HEAT TRANSFER MEASUREMENTS RELATED TO HOT TURBINE COMPONENTS IN THE VON KARMAN INSTITUTE HOT CASCADE TUNNEL
B. E. Richards *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13001# Sussex Univ., Brighton (England). Dept. of Mechanical Engineering.
STUDIES OF TURBULENCE CHARACTERISTICS AND THEIR EFFECTS UPON THE DISTRIBUTION OF HEAT TRANSFER TO TURBINE BLADING
F. J. Bayley and W. J. Priddy *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 15 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-12109*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SIMULATION COMPARISON OF A DECOUPLED LONGITUDINAL CONTROL SYSTEM AND A VELOCITY VECTOR CONTROL WHEEL STEERING SYSTEM DURING LANDINGS IN WIND SHEAR
G. Kimball, Jr. Nov. 1980 76 p refs
(NASA-TP-1734; L-13738) Avail: NTIS HC A05/MF A01 CSCL 01C

A simulator comparison of the velocity vector control wheel steering (VCWS) system and a decoupled longitudinal control system is presented. The piloting task was to use the electronic attitude direction indicator (EADI) to capture and maintain a 3 3 degree glide slope in the presence of wind shear and to complete the landing using the perspective runway included on the EADI. The decoupled control system used constant prefilter and feedback gains to provide steady state decoupling of flight path angle, pitch angle, and forward velocity. The decoupled control system improved the pilots' ability to control airspeed and flight path angle during the final stages of an approach made in severe wind shear. The system also improved their ability to complete safe landings. The pilots preferred the decoupled control system in severe winds and, on a pilot rating scale, rated the approach and landing task with the decoupled control system as much as 3 to 4 increments better than use of the VCWS system. R.K.G.

N81-12110*# Systems Technology, Inc., Hawthorne, Calif.
PRACTICAL OPTIMAL FLIGHT CONTROL SYSTEM DESIGN FOR HELICOPTER AIRCRAFT. VOLUME 2: SOFTWARE USER'S GUIDE Final Report
Susan A. Riedel Mar. 1979 254 p refs
(Contract NAS2-9946)
(NASA-CR-152306; TR-1127-1-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 01C

A method by which modern and classical control theory techniques may be integrated in a synergistic fashion and used in the design of practical flight control systems is presented. A general procedure is developed, and several illustrative examples are included. Emphasis is placed not only on the synthesis of the design, but on the assessment of the results as well. The first step is to establish the differences, distinguishing characteristics and connections between the modern and classical control

theory approaches. Ultimately, this uncovers a relationship between bandwidth goals familiar in classical control and cost function weights in the equivalent optimal system. In order to obtain a practical optimal solution, it is also necessary to formulate the problem very carefully, and each choice of state, measurement and output variable must be judiciously considered. Once design goals are established and problem formulation completed, the control system is synthesized in a straightforward manner. Three steps are involved: filter-observer solution, regulator solution, and the combination of those two into the controller. Assessment of the controller permits and examination and expansion of the synthesis results. J.M.S.

N81-12111# Universite des Sciences et Techniques de Lille (France). Inst. de Mecanique des Fluides.

INFLUENCE OF LIGHT AIRCRAFT ARCHITECTURE ON ITS SPIN CHARACTERISTICS [INFLUENCE DE L'ARCHITECTURE DES AVIONS LEGERS SUR LEUR VRILLE]

L. Beaurain Paris Association Aeronautique et Astronautique de France 1980 40 p In FRENCH; ENGLISH summary Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-11; ISBN-2-7170-0607-9) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

The effects of the geometry of certain elements on aircraft spin characteristics are deduced from a parametric study performed in a vertical wind tunnel using a free model. Some verifications in actual flight were also done. It is shown that the most critical factors are the rear body cross section and the vertical location of the tail control surface. Several measures to improve spin recovery are discussed. Author (ESA)

N81-12112# Universite des Sciences et Techniques de Lille (France). Inst. de Mecanique des Fluides.

SOME NEW RESEARCH APPROACHES TO AIRCRAFT SPIN STUDIES [QUELQUES NOUVEAUX AXES DE RECHERCHE DANS LE DOMAINE DE LA VRILLE]

M. Vanmansart and D. Tristrant Paris Association Aeronautique et Astronautique de France 1980 29 p In FRENCH; ENGLISH summary Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-12; ISBN-2-7170-0608-7) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

Included are a statistical correlation between aircraft geometry and spin and recovery characteristics, the analytical elaboration of actual flight data records, and a quantitative analysis of the conventional free spin test method in vertical wind tunnels are included. The development of better telemetry instrumentation for free spin model testing and the utilization of a rotative balance are discussed. Author (ESA)

N81-12113# Royal Aircraft Establishment, Bedford (England). Flight Systems Dept.

THE FLYING QUALITIES OF AIRCRAFT WITH ACTIVELY AUGMENTED PITCH AND YAW STABILITY

W. J. G. Pinsker London Feb. 1979 94 p refs Supersedes RAE-TR-79 and ARC 38234

(ARC-R/M-3848; RAE-TR-79029; ARC-38234) Avail: NTIS HC A05/MF A01; HMSO £16 PHI

Ignoring the dynamics of the automatic control loop hardware, the effects were studied on rigid body mode stability, gust response and pilot control of aircraft in which relaxed longitudinal or directional stability is augmented by various alternative feedbacks to the elevator and rudder. It is shown that indirect augmentation by such methods as feedback of pitch rate, integral pitch rate or normal acceleration in longitudinal case or lateral acceleration in the directional case can give rise to significant adverse characteristics which could limit the amount of instability which can be so corrected or which may demand additional corrective feedback loops. Direct feedback of incidence or sideslip will restore behavior indistinguishable from that of naturally stable configurations, provided these quantities can be sensed accurately and reliably. Attention is drawn to difficulties with indirect feedbacks in maintaining stability near and beyond the stall and to gust response characteristics. Author (ESA)

N81-12114# National Technical Information Service, Springfield, Va.

CLOSED LOOP CONTROL SYSTEMS: AIRCRAFT. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1975 - Jun. 1980

Guy E. Habercom, Jr. Jul. 1980 147 p Supersedes NTIS/PS-79/0904 and NTIS/PS-78/0809

(PB80-813710; NTIS/PS-79/0904; NTIS/PS-78/0809) Avail: NTIS HC $30.00/MF $30.00 CSCL 01C

Adaptive control and feedback control closed loop systems relative to aircraft flight control are investigated. Studies on guidance and control of drones and remotely piloted vehicles are included. This updated bibliography contains 164 citations, 22 of which are new entries to the previous edition. GRA

N81-12115# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

REPORT ON A COOPERATIVE PROGRAMME ON ACTIVE FLUTTER SUPPRESSION

London Aug. 1980 55 p refs In ENGLISH and FRENCH Meeting held in Athens, Apr. 1980

(AGARD-R-689; ISBN-92-835-0270-2) Avail: NTIS HC A04/MF A01

The results of a cooperative program on active flutter suppression on a dynamic model of the YF-17 aircraft are presented. Control laws for active flutter suppression were derived for one explosive wing-store flutter case of the model. Phase control laws were all tested and compared during wind tunnel tests performed in the Langley 16 ft wind tunnel. Results were quite promising and open the way for future cooperation on full-scale aircraft. For individual titles, see N81-12116 through N81-12119.

N81-12116*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

WIND TUNNEL TEST OF A FIGHTER AIRCRAFT WING/STORE FLUTTER SUPPRESSION SYSTEM: AN INTERNATIONAL EFFORT

C. Hwang, E. H. Johnson, G. R. Mills, T. E. Noll, and M. G. Farmer *In* AGARD Rept. on a Coop. Programme on Active Flutter Suppression Aug. 1980 23 p refs Prepared in cooperation with Northrop Corp., Hawthorne, Calif. and AFFDL, Wright-Patterson AFB, Ohio (For primary document see N81-12115 03-08)

Avail: NTIS HC A04/MF A01 CSCL 01C

A 30% scale, half span model of a lightweight fighter aircraft with an active wing/store flutter suppression system was tested in the NASA Langley Research Center sixteen foot transonic dynamics tunnel. The test featured a store configuration that was intentionally designed to exhibit a violent flutter condition. In addition to Northrop organized control laws, three European countries also contributed control laws to stabilize this condition. After the control laws were mechanized by Northrop, they were tested at the Langley facility. The model was tested up to 170% of the open loop flutter dynamic pressure in a number of cases, with the indication that a substantially greater improvement was achievable. Some special features of the test model are discussed and the design and implementation of the control laws as well as the test monitoring techniques and results are presented. R.C.T.

N81-12117# Messerschmidt-Boelkow G.m.b.H., Munich (West Germany). Airplane Div.

ACTIVE CONTROL OF AN EXPLOSIVE WING-STORE FLUTTER CASE

H. Honlinger, O. Sensburg, M. Kuhn, and H. Godel *In* AGARD Rept. on Coop. Programme on Active Flutter Suppression Aug. 1980 8 p refs (For primary document see N81-12115 03-08)

Avail: NTIS HC A04/MF A01

Control laws were calculated, using optimal control theory, to suppress an explosive wing-store flutter case on a YF-17 dynamically scaled model. The trailing edge flap was used for flutter suppression because usually hydraulically driven ailerons are available in modern fighters. The design aim of 1.5 times the flutter dynamic pressure was demonstrated during the wind tunnel test. It is shown that no changes to the analytically developed control law were necessary in the test which proves that theory has well advanced during the last years. R.C.T.

N81-12118# Office National d'Etudes et de Recherches Aerospatiales. Leclerc (France).
TEST AND ANALYSES OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM ON AN FFDL MODEL OF YF17
Roger Destuynder *In* AGARD Rept. on Coop. Programme on Active Flutter Suppression Aug. 1980 8 p refs In FRENCH; ENGLISH summary (For primary document see N81-12115 03-08)
Avail: NTIS HC A04/MF A01

A flutter control law was calculated for a YF-17 model equipped with a store at the wingtip. The control law used stiffness injection on the wing by the help of the unsteady aerodynamic forces induced by a control surface. The leading edge control surface and only one accelerometer, located in the wing close to the nodal line of the pitching mode of the external store, were used. During the wind tunnel tests the nominal control law was used without considering the existing differences between eigen modes and frequencies introduced in the calculations and eigen modes and frequencies existing on the model itself when mounted in the wind tunnel. The control at constant Mach number M = 0.80, permitted to increase substantially the dynamic critical pressure and also to reduce considerably the explosivity of the flutter phenomenon. R.C.T.

N81-12119# British Aerospace Aircraft Group, Bristol (England).
WIND TUNNEL TESTS ON A FIGHTER AIRCRAFT WING/STORE FLUTTER SUPPRESSION SYSTEM: THE B.Ae CONTROL LAW
M. R. Turner *In* AGARD Rept. on Coop. Programme on Active Flutter Suppression Aug. 1980 10 p refs (For primary document see N81-12115 03-08)
Avail: NTIS HC A04/MF A01

A B.Ae control law designed using analytical data was tested on a model of the YF-17 in the NASA Langley 16 foot wind tunnel and succeeded in meeting the requirement to increase the flutter dynamic pressure by 70% at M = 0.8. Because the store configuration chosen for these tests produced a flutter mechanism which was both hard and near to classical frequency coalescence, it was necessary to use a multiple output control law to achieve the stability margin objectives of + or - 60 deg and + or - 6dB. The B.Ae control law was designed using a novel procedure which provides these stability margins, uses minimum control surface movement in turbulence and can be designed using either analytical or empirical data. Two wing tip accelerometers and a leading edge control surface were used. Empirical open loop transfer functions obtained during the test showed that the analytical data overestimated the response of the flutter mode to leading edge control surface excitation.
R.C.T.

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-12120*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
EFFECTS OF BOUNDARY-LAYER TREATMENT ON CRYOGENIC WIND-TUNNEL CONTROLS Progress Report, period ending Aug. 1980
S. Balakrishna Aug. 1980 62 p refs
(Grant NsG-1503)
(NASA-CR-159372) Avail: NTIS HC A04/MF A01 CSCL 14B

Various techniques of realizing the desired boundary layer wall mass removal are considered in order to obtain the desired flow field over the model for various airfoils. The complementary problem of overall thermodynamic equilibrium maintenance created by the side wall boundary layer bleed is also addressed.
R.C.T.

N81-12121*# Old Dominion Univ., Norfolk, Va. Dept. of Mechanical Engineering and Mechanics.
MODELING AND CONTROL OF TRANSONIC CRYOGENIC WIND TUNNEL: A SUMMARY REPORT Final Report, period ending Oct. 1980
S. Balakrishna Oct. 1980 53 p refs
(Grant NsG-1503)
(NASA-CR-159376) Avail: NTIS HC A04/MF A01 CSCL 14B

A representative, control compatible, mathematical model of a cryogenic wind tunnel was synthesized which describes the unsteady behavior of the tunnel. The performance of this model was validated by appropriate transient and quasisteady state tests on the 0.3 m transonic cryogenic tunnel. An understanding was developed of the cryogenic tunnel behavior by an appropriate interactive real time simulation of the developed model. R.C.T.

N81-12122# Military Vehicles and Engineering Establishment, Christchurch (England). Trials Branch.
TEST TRACK FACILITIES
London Dec. 1979 95 p Supersedes MVEE-MEMO-71061 Original contains color illustrations
(MVEE-MEMO-79021; FVF/40/12; BR74775; MVEE-MEMO-71061) Avail: NTIS HC A05/MF A01

The general description and detailed specifications of three military vehicle test facilities situated at Longcross, Bagshot, and Long Valley (England) are presented. These test track complexes include all surface tracks and static test facilities, a wheeled vehicle rough road and alpine circuits, and separate tracked and wheeled cross country circuits. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N81-12123*# Colorado Univ., Boulder.
SCIENTIFIC MANAGEMENT AND IMPLEMENTATION OF THE GEOPHYSICAL FLUID FLOW CELL FOR SPACELAB MISSIONS Quarterly Progress Report, period ending 30 Sep. 1980
John Hart and Juri Toomre 30 Sep. 1980 5 p refs
(Contract NAS8-31958)
(NASA-CR-161612) Avail: NTIS HC A02/MF A01 CSCL 22A

Scientific support for the spherical convection experiment to be flown on Spacelab 3 was developed. This experiment takes advantage of the zero gravity environment of the orbiting space laboratory to conduct fundamental fluid flow studies concerned with thermally driven motions inside a rotating spherical shell with radial gravity. Such a system is a laboratory analog of large scale atmospheric and solar circulations. The radial body force necessary to model gravity correctly is obtained by using dielectric polarization forces in a radially varying electric field to produce radial accelerations proportional to temperature. This experiment will answer fundamental questions concerned with establishing the preferred modes of large scale motion in planetary and stellar atmospheres. Author

N81-12124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NOSS FLIGHT SEGMENT CONCEPT STUDY Final Report
9 Nov. 1979 196 p refs
(NASA-TM-82307) Avail: NTIS HC A09/MF A01 CSCL 22A

An 11 ft wide by 26.5 ft long flat structure weighing almost 14,469 pounds evolved during a low level, inhouse conceptual design study for a national oceanic satellite system spacecraft that would stow directly in the space shuttle. Following STS launch to a 300 Km mission orbit inclination, transfer will be effected to a 800 Km Sun synchronous circular orbit. The instrument completement includes 2 altimeters, 1 scatterometer, 1 large antenna multichannel microwave radiometer, and a coastal zone scanner. The spacecraft, its instruments, and interfaces with STS and TDRSS are described. The mission timeline, potential problem areas, system drivers, and recommended study areas

are discussed. Drawings and system block diagrams are included. A.R.H.

N81-12125# Swedish Board for Space Activities, Solna.
SWEDISH SPACE ACTIVITIES DURING 1979 Annual Report
25 Jan. 1980 9 p
Avail: NTIS HC A02/MF A01

Space applications programs involving remote sensing of Earth resources and environment, meteorology, communications, navigation, and related data processing tasks are discussed. Scientific space programs, such as magnetospheric and ionospheric physics studies as well as investigations into the upper atmosphere, astrophysics, and material sciences are also discussed. Participation in satellite, sounding rocket, and balloon and airplane programs is outlined. Ground space-related facilities and installations are described. Author (ESA)

N81-12126# Finnish National Committee of COSPAR, Otaniem.
SPACE ACTIVITIES IN FINLAND IN 1979 Annual Report
M. Tiuri, ed. and S. Urpo, ed. 1979 10 p refs
Avail: NTIS HC A02/MF A01

Space applications programs included remote sensing of Earth resources using LANDSAT. Forestry surveys, smallscale land use mapping and classification, and image enhancement for visual interpretation are mentioned. Daily use was made of automatic picture transmission (APT) photographs and infrared pictures from U.S. operational satellites. Communications activities include troposphere scintillation studies using INTELSAT 4, propagation experiments using SIRIO and OTS satellites, and use of APT pictures for ice surveys. The location and instrumentation of Finnish geophysical stations are shown and ionosphere and magnetosphere research outlined. Satellite geodesy activities included laser ranging of LAGEOS, GEOS-1, GEOS-3, and Starlette. Author (ESA)

N81-12127# Centre National d'Etudes Spatiales, Paris (France).
FRENCH SPACE PROGRAMS FOR 1979 [PROGRAMME SPATIAL FRANCAIS]
1979 128 p refs In FRENCH Presented at 23rd COSPAR Meeting, Budapest, 2-14 Jun. 1980 Prepared in cooperation with Comite National Francais de Recherches dans l'Espace (CNFRE)
Avail: NTIS HC A07/MF A01

The organization of the French program is described together with the way in which different tasks are assigned. The main sectors of activity are: astronomy and solar physics; the solar system; physics of the ionosphere and the magnetosphere; aeronomy; meteorology; Earth resources; and space geodesy and geodynamics, space biology and medicine. The specific activities pursued by the different laboratories, organizations, and working groups in the framework of these sectors of activity are described. Author (ESA)

N81-12128# Aeritalia S.p.A., Torino (Italy). Settore Spazio.
BIRAMIS SATELLITE DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Report
Paris ESA Jul. 1979 58 p 2 Vol.
(Contract ESA-3743/78-NL-PP(SC))
(ESA-CR(P)-1354-Vol-1) Avail: NTIS HC A04/MF A01

A summary of the BIRAMIS definition study is presented. The primary mission objective is the determination of the Earth radiation budget by employing a micro-accelerator (Super Cactus) to measure the nongravitational forces acting on the spacecraft skin. The mission and systems analysis as well as the subsystems study and satellite operations are presented. It is concluded that the overall error, being caused mainly by inertial acceleration, is about three times larger than the specified value. Several remedies are proposed to reach a full demonstration of mission feasibility. Author (ESA)

N81-12129# Aeritalia S.p.A., Torino (Italy). Settore Spazio.
BIRAMIS SATELLITE DEFINITION STUDY. VOLUME 2: TECHNICAL STUDY Final Report
Paris ESA Jul. 1979 297 p 2 Vol.
(Contract ESA-3743/78/NL-PP(SC))
(ESA-CR(P)-1354-Vol-2) Avail: NTIS HC A13/MF A01

The Earth radiation budget was determined by employing a microaccelerator (Super Cactus) to measure the nongravitational forces acting on the spacecraft skin. The mission and system analysis as well as the subsystems study and satellite operations are presented. It is concluded that the overall error, being caused mainly by inertial acceleration, is about three times larger than the specified value. Several remedies are proposed to reach a full demonstration of mission feasibility. Author (ESA)

N81-12991*# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MATERIALS PROCESSING IN SPACE: FUTURE TECHNOLOGY TRENDS
Neville J. Barter *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 159-177 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 22A

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N81-12130# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
INTERLEVEL CORRELATIONS OF TEMPERATURE AND DENSITY, SURFACE TO 60 KM Interim Scientific Report
Allen E. Cole, Arthur S. Kantor, and Eugene A. Bertoni 14 May 1980 124 p refs
(AF Proj. 6670)
(AD-A090515; AFGL-TR-80-0163; AFGL-ERP-701) Avail: NTIS HC A06/MF A01 CSCL 16/2

Statistical techniques have been developed which can be used to determine the effect of density and temperature on the trajectories of reentry vehicles for altitudes between the surface and 60 km. Arrays of monthly means and standard deviations of density and temperature at 2 km intervals of altitude to 60 km, together with interlevel coefficients of correlation of density with density and temperature, are provided for the mid-season months (January, April, July, October) at 10 locations between latitudes 8 deg and 64 deg N. These data are in format that can be easily used to estimate the distributions of vertical density and temperature gradients and the effects of day-to-day density variations on the trajectories of reentry vehicles. GRA

N81-12131# Technische Hogeschool, Delft (Netherlands). Luchtvaart- en Ruimtevaarttechniek.
STATION CONTROL AND THE ORBIT OF SKYLAB DURING THE PERIOD APRIL 1978 TO JULY 1979 [DE STANDREGELING EN DE BAAN VAN SKYLAB GEDURENDE DE PERIODE APRIL 1978 TOT JULI 1979]
Nov. 1979 46 p refs In DUTCH; ENGLISH summary
(VTH-LR-288) Avail: NTIS HC A03/MF A01

Some NASA and North American Air Defense command Skylab parameters are presented; the effects of attitude maneuvers and solar activity on the time history of the Skylab vehicle are shown. The efforts made to prevent reentry over populated areas are described. Predictions of reentry data are summarized and some results from observers within the Netherlands are presented. Author (ESA)

N81-12132# Royal Aircraft Establishment, Farnborough (England).
LUMPED HARMONICS OF 15TH AND 30TH ORDER IN THE GEOPOTENTIAL FROM THE RESONANT ORBIT OF 1971-54A
D. G. King-Hele London HMSO Jul. 1980 32 p refs
(RAE-TR-80088; RAE-Space-582; BR75505) Avail: NTIS HC A03/MF A01

The values of orbital inclination and eccentricity from 269 weekly orbits between November 1972 and January 1978 were analyzed to determine 12 lumped harmonic coefficients of order 15 and 30. The analysis of inclination yields 15th order coefficients accurate to 1.5% and 2.8%, and 30th order coefficients accurate to 7%. The analysis of eccentricity gives two 15th order coefficients accurate too 3% and 4%. These lumped harmonic

coefficients are to test the accuracy of the Goddard Earth Model 10B, which is complete to order and degree 36. The agreement with GEM 10B is excellent, for both 15th and 30th order, and shows that GEM 10B is more accurate than was expected. The 12 values of lumped harmonics obtained give 12 linear equations between individual coefficients of order 15 and 30.

Author (ESA)

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N81-12133*# General Dynamics/Convair, San Diego, Calif.
GEOSTATIONARY PLATFORM SYSTEMS CONCEPTS DEFINITION FOLLOW-ON STUDY. VOLUME 2A: TECHNICAL TASK 2 LSST SPECIAL EMPHASIS Final Report
Sep. 1980 151 p refs
(Contract NAS8-33527)
(NASA-CR-161597; GPP-79-010-Vol-2A) Avail: NTIS HC A08/MF A01 CSCL 22B

The results of the Large Space Systems Technology special emphasis task are presented. The task was an analysis of structural requirements deriving from the initial Phase A Operational Geostationary Platform study. T.M.

N81-12134*# Engineering Analysis, Inc., Huntsville, Ala.
SHUTTLE SIMULATION TURBULENCE TAPES SSTT USERS GUIDE
Frank B. Tatom Sep. 1980 56 p refs
(Contract NAS8-33818)
(NASA-CR-161604; EAI-TR-80-002) Avail: NTIS HC A04/MF A01 CSCL 14B

A guide for potential users of Shuttle Simulation Turbulence Tapes is presented. It provides an appropriate description of the characteristics of the simulated turbulence stored on the tapes as well as instructions regarding their proper use. The characteristics of the turbulence series, including the spectral shape, cutoff frequencies, and variation of turbulence parameters with altitude, are discussed. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-12135*# Dayton Univ., Ohio.
APPLICATIONS TECHNOLOGY SATELLITE AND COMMUNICATIONS TECHNOLOGY SATELLITE USER EXPERIMENTS FOR 1967 - 1980 REFERENCE BOOK, VOLUME 1 Final Report
Nicolas A. Engler, John F. Nash, and Jenny D. Strange Aug. 1980 263 p 4 Vol.
(Contracts NAS3-21370; NAS3-19699; NAS3-20392)
(NASA-CR-165169-Vol-1; UDR-TR-80-99-Vol-1) Avail: NTIS HC A12/MF A01 CSCL 22B

A description of each of the satellites is given and a brief summary of each user experiment is presented. A Cross Index of User Experiments sorted by various parameters and a listing of keywords versus Experiment Number are presented. Author

N81-12136*# Dayton Univ., Ohio.
APPLICATIONS TECHNOLOGY SATELLITE AND COMMUNICATIONS TECHNOLOGY SATELLITE USER EXPERIMENTS FOR 1967-1980 REFERENCE BOOK, VOLUME 2 Final Report
Nicholas A. Engler, John F. Nash, and Jenny D. Strange Aug. 1980 370 p refs 4 Vol.
(Contracts NAS3-21370; NAS3-19699; NAS3-20392)
(NASA-CR-165169-Vol-2; UDR-TR-80-100-Vol-2) Avail: NTIS HC A16/MF A01 CSCL 22B

The experiments are grouped by type of service offered; for example, education, health services, and data transmission. A bibliography of reports by accession number and by author are also presented. A listing of keywords versus report number is presented. Author

N81-12137*# Dayton Univ., Ohio.
APPLICATIONS TECHNOLOGY SATELLITE AND COMMUNICATIONS TECHNOLOGY SATELLITE USER EXPERIMENTS FOR 1967-1980 REFERENCE BOOK. VOLUME 3: USER FORM SURVEYS Final Report
Nicholas A. Engler, John F. Nash, and Jenny D. Strange Aug. 1980 340 p refs 4 Vol.
(Contracts NAS3-21370; NAS3-19699; NAS3-30292)
(NASA-CR-165169-Vol-3; UDR-TR-80-101-Vol-3) Avail: NTIS HC A15/MF A01 CSCL 22B

Questionnaires received from the satellite users are presented. Questionnaires were sent to users in 1976, 1977 and 1979. The forms reflect user viewpoints of the systems. Author

N81-12138*# Dayton Univ., Ohio.
APPLICATIONS TECHNOLOGY SATELLITE AND COMMUNICATIONS TECHNOLOGY SATELLITE USER EXPERIMENTS FOR 1967-1980 REFERENCE BOOK. VOLUME 4: ABSTRACTS Final Report
Nicholas A. Engler, John F. Nash, and Jerry D. Strange Aug. 1980 677 p refs
(Contract NAS3-21370)
(NASA-CR-165169-Vol-4; UDR-TR-80-102-Vol-4) Avail: NTIS HC A99/MF A01 CSCL 22B

The important user experiments conducted during the fourteen year period from 1966 to 1980 are summarized. A description of each of the satellites and a brief summary of each user experiment is presented. A cross index of user experiments sorted by various parameters and a listing of keywords versus experiment number is included. The experiments are grouped by type of service offered; for example, education, health services, and data transmission. A bibliography of reports by accession number and by author is also presented. User viewpoints of the systems are presented. Author

N81-12139*# Columbia Univ., New York. Dept. of Electrical Engineering.
NEXT GENERATION COMMUNICATIONS SATELLITES: MULTIPLE ACCESS AND NETWORK STUDIES Final Report
T. E. Stern, M. Schwartz, H. E. Meadows, H. K. Ahmadi, J. G. Gadre, I. S. Gopal, and K. Matsmo Jul. 1980 174 p refs
(Contract NAS5-25759)
(NASA-CR-165145; FR-1) Avail: NTIS HC A08/MF A01 CSCL 22B

Following an overview of issues involved in the choice of promising system architectures for efficient communication with multiple small inexpensive Earth stations serving hetergeneous user populations, performance evaluation via analysis and simulation for six SS/TDMA (satellite-switched/time-division multiple access) system architectures is discussed. These configurations are chosen to exemplify the essential alternatives available in system design. Although the performance evaluation analyses are of fairly general applicability, whenever possible they are considered in the context of NASA's 30/20 GHz studies. Packet switched systems are considered, with the assumption that only a part of transponder capacit is devoted to packets, the integration of circuit and packet switched traffic being reserved for further study. Three types of station access are distinguished: fixed (FA), demand (DA), and random access (RA). Similarly, switching in the satellite can be assigned on a fixed (FS) or demand (DS) basis, or replaced by a buffered store-and-forward system (SF) onboard the satellite. Since not all access/switching combinations are practical, six systems are analyzed in detail: three FS SYSTEMS, FA/FS, DA/ES, RA/FS; one DS system, DA/DS; and two SF systems, FA/SF, DA/SF. Results are presented primarily in terms of delay-throughput characteristics. J.M.S.

N81-12140*# Old Dominion Univ., Norfolk, Va.
INFLUENCE OF NONEQUILIBRIUM RADIATION AND SHAPE CHANGE ON AEROTHERMAL ENVIRONMENT OF JOVIAN ENTRY BODY Final Report, 1 Aug. 1979 - 29 Feb. 1980
S. N. Tiwari and S. V. Subramanian Aug. 1980 176 p refs (Grant NsG-1500)
(NASA-CR-163795) Avail: NTIS HC A09/MF A01 CSCL 22B

Radiative transfer equations are derived under nonequilibrium conditions which include multilevel energy transitions. The nonequalibrium results, obtained with and without ablation injection in the shock layer, are found to be greatly influenced by the temperature distribution in the shock layer. In the absence of ablative products, the convective and radiative heating to the entry body are reduced significantly under nonequilibrium conditions. The influence of nonequilibrium is found to be greater at higher entry altitudes. With coupled ablation and carbon phenolic injection, 16 chemical species are used in the ablation layer for radiation absorption. Equilibrium and nonequilibrium results are compared under peak heating conditions. A 45 degree sphere cone, a 35 degree hyperboloid, and a 45 degree ellipsoid were used to study probe shape change. Results indicate that the shock layer flow field and heat transfer to the body are influenced significantly by the probe shape change. The effect of shape change on radiative heating of the afterbodies is found to be considerably larger for the sphere cone and ellipsoid than for the hyperboloid. A.R.H.

N81-12141# RADEX, Inc., Carlisle, Mass.
ANALYSIS OF SPACECRAFT CHARGING AND GEOPHYSICAL DATA BASES Final Report, 1 Nov. 1978 - 30 Apr. 1980
Krishin H. Bhavnani, Maurice F. Tautz, and Edward J. Ziemba Hanscom AFB, Mass. AFGL 31 Jul. 1980 76 p refs (Contract F19628-79-C-0014; AF Proj. 9993)
(AD-A090020; AFGL-TR-80-0173) Avail: NTIS HC A05/MF A01 CSCL 22/1

This report documents investigations and computer programs developed for analysis of spacecraft charging and geophysical data bases. Spacecraft charging studies were performed using the NASCAP and associated MATCHG programs. Simple as well as complex SCATHA models were configured, and results for materials charging, rotation effects, potential monitor, and gun events in different environments were simulated. NASCAP verification and validation to date is summarized. Ion composition modeling was initiated using mass spectrometer measurements of N, O, N2, NO and O2 ion densities on board the S3-1 satellite. Procedures for partitioning, editing, averaging, and analyzing the geophysical data base are described. Graphical presentation techniques are used extensively, and provide a basis for subsequent modeling. An interactive graphics program (SUATEK) was developed to satisfy requirements for flexible data presentation and evaluation by researchers. Data manipulation, editing, as well as selective plotting features are available, and operate on a standardized data base format. On-line Tektronix and Off-line Pen-and-Ink, Microfiche, or Tektronix compatibility is retained as far as possible. GRA

N81-12142# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SPIN JET DAMPING OF ROCKET-ASSISTED PROJECTILES Final Report
Charles H. Murphy Aug. 1980 23 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A089980; ARBRL-MR-03052) Avail: NTIS HC A02/MF A01 CSCL 19/1

A theory is developed to predict the spin-up of a rocket-assisted projectile during burning. The percentage change in spin is show to be proportional to the percentage change in the spin moment of inertia. Observed 2% increments in spin are about half the predicted maximum increment. GRA

N81-12143# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ARTIFICIAL SATELLITES, MINOR PLANETS, AND THE ETS
David E. Beatty, John M. Sorvari, and Laurence G. Taff 26 Aug. 1980 39 p refs
(Contract F19628-80-C-0002; AF Proj. 3221)
(AD-A089823; ETS-53; ESD-TR-80-81) Avail: NTIS HC A03/MF A01 CSCL 17/8

This report summarizes the successful modification of Lincoln Laboratory's Experimental Test System hardware and software for the detection and discrimination of asteroids rather than artificial satellites. The minor planets are found by exploiting their proper motion and the limiting magnitude is roughly brightness magnitude = 17.5. The complete observing cycle, including the 2 - 3 sec measurement of position, requires about four minutes at present. The commonality of asteroids and artificial satellite observing, searching, data reduction, orbital analysis, and lightcurve analysis is stressed. GRA

N81-12144# Naval Ocean Systems Center, San Diego, Calif. Avionics Systems Branch.
OPTIMAL ESTIMATION OF MISSILE FREE-FLIGHT TRAJECTORY: COMPARATIVE RESULTS OF LINEAR AND NONLINEAR KALMAN FILTER APPROACHES Final Report, Apr. - Jul. 1980
F. Dale Groutage 10 Jul. 1980 66 p refs
(AD-A090717; NOSC/TR-341) Avail: NTIS HC A04/MF A01 CSCL 16/2

This is a technical report on the application of optimal estimation theory for estimating the trajectory of a free-flight missile, as a means of evaluating missile performance. Several approaches were investigated (linear Kalman filter working in Cartesian Coordinates and nonlinear extended Kalman filter implemented in Cartesian Coordinates). A six-degree of freedom simulation was used to generate the free-flight trajectory of the missile. A simulated radar, positioned at the origin of the inertial ground reference frame, generated range, azimuth, and elevation observation data. An analysis was conducted in the following three areas: (1) initialization, (2) Q matrix weighting, and (3) observation of noise variances. The nonlinear filter approach (linear dynamics with nonlinear measurements) proved to exhibit superior performance over a strictly linear filter approach. Further investigations in specific areas, are recommended. GRA

N81-12145# National Range Operations Directorate, White Sands Missile Range, N. Mex.
IMPROVED METHODS FOR COMPUTING DRAG CORRECTED MISSILE IMPACT PREDICTIONS IN REAL TIME
Jerry F. Kuzanek Jun. 1980 13 p refs
(AD-A090413) Avail: NTIS HC A02/MF A01 CSCL 16/2

During missile flight tests at White Sands Missile Range (WSMR), position data on the current status of the missile is transmitted 20 times per second from radar sites to a Univac 1108 computer. Consecutive pairs of such data are averaged 10 times per second and computations for plotting displays such as current position, range verses altitude, or impact prediction are based upon this averaged data. In the event that a missile veers from its planned trajectory, it will be necessary to determine thrust to prevent the missile from impacting in a populated area. For this reason, the Range Safety Officer (RSO) requires that for each computational cycle (10 per second) an instantaneous impact prediction (IIP) of the missile be computed. This point is the intersection of the missile trajectory, should thrust be terminated, with the Clarke Spheroid (of 1866) model of the Earth at an altitude of 4000 feet. GRA

N81-12146# Rockwell International Corp., Seal Beach, Calif.
BACKGROUND MOTION EFFECTS ON STARING SENSORS AND THE RELATIVE EFFECTIVENESS OF SIGNAL PROCESSING FILTERS IN MINIMIZING SUCH EFFECTS ON TARGET DETECTION
A. K. Mukhopadhyay and W. H. Haas 1980 9 p refs
(AD-A090644) Avail: NTIS HC A02/MF A01 CSCL 09/4

The objectives of this study are to characterize apparent background motion as a function of observer-satellite orbit and sighting geometry and then to compare the effectiveness of signal processing filters in minimizing background motion effects on target detection. For many applications, complex algorithms cannot be realized economically, so simple yet effective algorithms must be developed to do the job. In this study both ideal and optimum third-order temporal recursive filters were synthesized and their simulated signal-to-noise ratio performance compared with that obtained by simple temporal differencing (first-through fourth-

order). Our results indicate that for the same amount of memory, compared to the differencing filters, significant SNR performance improvement can be achieved with optimum recursive filters at the cost of a modest increase in filter complexity. The study is particularly pertinent to the detection by a staring mosaic sensor of aircraft from satellites in high (= 1000 kilometer) orbits. They are typically dim targets flying close to a structured background (the Earth's surface), and the background clutter tends to dominate the detection problem. GRA

N81-12147# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

SPACECRAFT CHARGING ON ATS-5 Interim Scientific Report

A. G. Rubin, H. B. Garrett, and A. H. Wendel 14 May 1980 13 p refs

(AF Proj. 7661)

(AD-A090508; AFGL-TR-80-0168; AFGL-AFSG-426) Avail: NTIS HC A02/MF A01 CSCL 22/2

The distribution of plasma electron and proton temperature at the time of spacecraft charging events during eclipse are obtained from ATS-5 data for 1969 to 1971. The mean RMS electron temperature is 3 keV and the highest value measure is 6.5 keV. The mean RMS ion temperature is 9 keV; the highest value is 12 keV. The current-voltage characteristic curve shows that a threshold current for charging exists which is 0.000001 A/sq m. The charging current has a narrow distribution around 0.0000015 A/sq m. The spacecraft ground potential varies approximately linearly with RMS plasma electron temperature consistent with the behavior of a dielectric probe in a plasma. GRA

N81-12148# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.

GROUNDBASED PREDICTORS OF SPACECRAFT CHARGING DURING ECLIPSE PASSAGE

Arthur H. Wendel 20 Mar. 1980 22 p refs

(AF Proj. 7661)

(AD-A090338; AFGL-TR-80-0088; AFGL-AFSG-422) Avail: NTIS HC A02/MF A01 CSCL 22/1

Several topics are summarized in the areas of excimer ground state kinetics, coherent pulse evolution in a CO2 amplifier, photopreionization and operation of a multi-atmosphere TEA laser, relaxation of He2 excimers and highly stripped GRA

N81-12149# Boeing Aerospace Co., Seattle, Wash. Engineering Technology Div.

NEW TECHNIQUES FOR TEST DEVELOPMENT FOR TACTICAL AUTO-PILOTS USING MICROPROCESSORS

Edward H. Shemeta 10 Jul. 1980 28 p refs

(AD-A090641) Avail: NTIS HC A03/MF A01 CSCL 16/4

This paper reports on a demonstration of the application of the method to generate system level tests for a typical tactical missile autopilot. The test algorithms are based on the autopilot control law. When loaded on the tester with appropriate control information, the complete autopilot is tested to establish if the specified control law requirements are met. Thus, the test procedure not only checks to see if the hardware is functional, but also checks the operational software. The technique also uses a 'learning' mode to allow minor timing or functional deviations from the expected responses to be incorporated in the test procedures. A potential application of this test development technique is the extraction of production test data for the various subassemblies. The technique will 'learn' the input-output patterns forming the basis for developement and production tests. If successful, these new techniques should allow the test development process to keep pace with semiconductor progress. GRA

N81-12150# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.

DEVELOPMENT OF A FOLD-OUT RIGID SOLAR ARRAY FOR THREE AXIS-STABILIZED GEOSYNCHRONOUS SATELLITES

Gerard Barkats Paris 1980 14 p refs

(SNIAS-801-440-101) Avail: NTIS HC A02/MF A01

This array was developed for point-to-point spacecraft communication purposes. The various components (panel, yoke, and wings), structures and special materials used are described together with the tilting and stowing mechanisms. The panel cell network is made up of four identical interchangeable subpanels. The masses of the different components are itemized. The functional behavior of the equipment is presented together with the results of the test program carried out. The end of life performance of the array is approximately 25 W/kg (with currently mass produced solar cells). Author (ESA)

N81-12151# European Space Agency, Paris (France).

THREE COMPONENT MEASUREMENTS ON A BODY WITH VARIOUS AFTERBODY CONFIGURATIONS IN SUBSONIC AND TRANSONIC FLOW

Mauri Tanner Jun. 1980 74 p refs Transl. into ENGLISH of 'Dreikomponenten-messungen an einem Flugkoerperrumpf mit verschiedenen Heckkonfigurationen im Unterschall-u. Transschallber.', DFVLR, Goettingen, West Ger. Report DFVLR-FB-79-15, Mar. 1979 Original report in German previously announced as N80-23265 Original German report available from DFVLR, Cologne DM 13,60

(ESA-TT-628; DFVLR-FB-79-15) Avail: NTIS HC A04/MF A01

The lift, drag and pitching moment coefficients of a missile body with boattailing were measured at Mach numbers from Ma = 0.5 to 1.0 at a Reynolds number of 340,000 in a transonic wind tunnel. The model was fitted with 14 different conical afterbodies, with boattail angles between 0 deg and 12 deg. Results show that the lift, drag, and the longitudinal stability of the body decrease when the relative base diameter decreases. Author (ESA)

N81-12152# British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.

SATELLITE POINTING ERRORS AND THEIR STATISTICS Final Report

L. Virdee Paris ESA Jul. 1979 476 p refs

(ESS/SS-957; ESA-CR(P)-1363) Avail: NTIS HC A21/MF A01

A unified, principally geometric framework for definition of satellite attitude pointing and measurement requirements, is defined, and a unified terminology established. The commonly encountered errors in satellite attitude control and attitude measurement systems are reviewed and a basis of categorization of the errors according to their temporal and statistical characteristics is defined. The categorization is extended to cover the errors in typical attitude measurement sensors. Three different configurations of attitude sensors are selected for deterministic and statistical error analyses, representing a mission of a communication, general scientific and Earth observation nature. Guidelines on the compilation of error budgets and the devolution of system level requirements to hardware and software requirements are given. Author (ESA)

N81-12153# Royal Aircraft Establishment, Farnborough (England).

SOLAR POWER SATELLITES. A REVIEW OF THE SPACE TRANSPORTATION OPTIONS

D. G. Fearn London HMSO Mar. 1980 194 p refs

(RAE-TR-80034; RAE-Space-577; BR74953) Avail: NTIS HC A09/MF A01

The options available for lifting both heavy payloads and personnel to low Earth orbit, and from there to geostationary orbit are reviewed. It is concluded that conventional launcher technology using liquid hydrogen/liquid oxygen engines should be adequate for the former task. The latter can best be accomplished using electric propulsion with ion thrusters being the most suitable devices, owing to their high efficiency and advanced state of development. Environmental effects of such a transportation system are considered and it is concluded that they should be acceptable. Author (ESA)

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

N81-12154*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Thermal Protection Systems.

PRODUCING THE HIGH TEMPERATURE REUSABLE SURFACE INSULATION FOR THE THERMAL PROTECTION SYSTEM OF THE SPACE SHUTTLE

Kevin Forgsberg Paris Association Aeronautique et Astronautique de France 1979 46 p Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979

(Contract M3J3XMA483011D)

(AAAF-NT-79-42; ISBN-2-7170-0590-0) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

The primary insulation system used to protect the space shuttle orbiter on reentry is an externally attached, rigidized, fibrous silica which has been machined into tiles. The tiles constitute the temperature reusable surface insulation system and are used on over 70 percent of the vehicle exterior surface where peak temperatures range from 400 to 1260 C. Cargon-carbon leading edges are used in areas where peak temperatures exceed 1650 C and a felt flexible insulation is used in regions below 400 C. Approximately 32,000 tiles are used in the HRST system and because of vehicle configuration, aerodynamic requirements, and weight considerations no two tiles are alike. Fabrication and quality control procedures are described.

Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-12155*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A TECHNOLOGY DEVELOPMENT PROGRAM FOR LARGE SPACE ANTENNAS

R. A. Russell, T. G. Campbell, and R. E. Freeland (JPL) Sep. 1980 45 p refs Presented at the 31st Intern. Astronautical Congr. of the Intern. Astronautical Federation, Tokyo, 21-28 Sep. 1980

(NASA-TM-81902; IAF-80-A-33) Avail: NTIS HC A03/MF A01 CSCL 22B

The design and application of the offset wrap rib and the maypole (hoop/column) antenna configurations are described. The NASA mission model that generically categorizes the classes of user requirements, as well as the methods used to determine critical technologies and requirements are discussed. Performance estimates for the mesh deployable antenna selected for development are presented. R.C.T.

N81-12156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHOD OF AND APPARATUS FOR DAMPING NUTATION MOTION WITH MINIMUM SPIN AXIS ATTITUDE DISTURBANCE Patent Application

Henry C. Hoffman, inventor (to NASA) Filed 29 Aug. 1980 21 p

(NASA-Case-GSC-12551-1; US-Patent-Appl-SN-182881) Avail: NTIS HC A02/MF A01 CSCL 22B

A method for damping nutation of a spinning spacecraft is described. The spin axis attitude disturbances were substantially reduced by controlling at least one nutation damping gas thruster to fire with nonuniform gas pulses. During the beginning of a nutation control sequence, the duration of successive gas pulses was gradually increased from zero to a predetermined maximum duration. The duration of successive pulses was then maintained constant for a time period. At the end of the nutation control sequence, the duration of successive gas pulses was gradually reduced to zero. NASA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N81-12157*# Lockheed Missiles and Space Co., Palo Alto, Calif. Applied Materials and Technology Lab.

STUDY OF A SOLID HYDROGEN COOLER FOR SPACECRAFT INSTRUMENTS AND SENSORS Final Report

Allan Sherman Aug. 1980 70 p refs

(Contract NAS5-25792)

(NASA-CR-160056; LMSC-D766177) Avail: NTIS HC A04/MF A01 CSCL 22B

The results of tests and studies to investigate the utilization of solid hydrogen for cooling of spacecraft instruments and sensors are presented. The results are presented in two sections; the first describing the tests in which an existing single stage solid cooler was filled and tested with solid hydrogen and the second which describes the analysis and design of a catalytic converter which will be tested in the vent line of the cooler. Author

N81-12158*# Sperry Flight Systems, Phoenix, Ariz.

DESIGN OF THE ANNULAR SUSPENSION AND POINTING SYSTEM (ASPS) (INCLUDING DESIGN ADDENDUM) Final Report

D. Cunningham, T. Gismondi, B. Hamilton, J. Kendig, J. Kiedrowski, A. Vroman, and G. Wilson Washington NASA Oct. 1980 247 p refs

(Contract NAS1-14214)

(NASA-CR-3343) Avail: NTIS HC A11/MF A01 CSCL 22B

The Annular Suspension and Pointing System is an experiment pointing mount designed for extremely precise 3 axis orientation of shuttle experiments. It utilizes actively controlled magnetic bearing to provide noncontacting vernier pointing and translational isolation of the experiment. The design of the system is presented and analyzed. T.M.

N81-12159# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction des Etudes de Synthese.

BIRAMIS: NUMERICAL EVALUATION OF THE OVERALL SYSTEM PRECISION [BIRAMIS: EVALUATION NUMERIQUE DE LA PRECISION GLOBALE DU SYSTEME]

A. M. Mainguy, A. Bernard, T. Duhamel, A. Girard, G. Gregoire, R. Juillerat, P. Marchal, F. Montigny, and C. Pastre Paris 5 Mar. 1980 285 p refs In FRENCH

(Contract ESA-3454/77)

(ONERA-RT-7/3373-SY; ESA-CR(P)-1368) Avail: NTIS HC A13/MF A01

The attainable precision for measurement of the Earth's

radiation balance using a satellite-borne microaccelerometer is shown. A numerical simulation of the system was done in order to evaluate the effects of the various parameters. The simulation model is described and the possible errors are analyzed in detail. The supercactus microaccelerator sensitivity is estimated as better than 10 to the minus 10th power. Recommended satellite surface characteristics, weight, dimensions, and attitude control are deduced from the analysis. For the specified satellite characteristics it is concluded that an absolute precision of less than eight Watt/sq m by day and four Watt/sq m by night is possible. Author (ESA)

N81-12160# Council of Europe, Strasbourg (France). Working Party on Geodynamics.
PROPOSALS TO USE MICRO-ACCELEROMETERS FOR SPACE GEODETIC EXPERIMENTS Final Report
Paris ESA Feb. 1980 57 p
(Contract ESA-4041/79-F-FC(SC))
(ESA-CR(P)-1371) Avail: NTIS HC A04/MF A01

An overview of the Biramis geodetic scientific programs is presented to define the modifications of the actual platform and the ground equipment to support the experiments involving the use of the microaccelerometer super-Cactus, which will be able to detect accelerations in the order of 10 to the minus 7th power to 10 to the minus 11th power. The scientific objectives include the determination of polar motion from a satellite tracking network, the action of non-gravitational forces on satellites and their incidence on geodesy, and the improvement of gravity field and tidal studies. The satellite instrumentation supporting the accelerometers is described. Author (ESA)

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N81-12161*# Aerojet Liquid Rocket Co., Sacramento, Calif.
ORBIT TRANSFER VEHICLE (OTV) ENGINE PHASE A STUDY, EXTENSION 1. VOLUME 3: STUDY COST ESTIMATES Final Report
K. L. Christensen 20 Aug. 1980 71 p refs
(Contract NAS8-32999)
(NASA-CR-161608; Rept-32999-F-E1-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 21H

Program cost and planning data based on 1980 technology and shown in 1979 dollars for a 20K lb Thrust Staged Combustion Cycle Engine are presented. These data were compared with those for the Advanced Expander Cycle Engine at 10K lb and 20K lb thrust levels. Author

N81-12162# TRW Defense and Space Systems Group, Redondo Beach, Calif.
MISSION INTEGRATION STUDY FOR SOLID TEFLON PULSED PLASMA MILLIPOUND PROPULSION SYSTEM Final Report, Aug. 1978 - Jun. 1980
M. N. Huberman, S. Zafran, M. H. Gran, R. Pieper, and J. M. Sellen Sep. 1980 183 p refs
(Contract F04611-78-C-0064; AF Proj. 3058)
(AD-A090514; AFRPL-TR-80-37) Avail: NTIS HC A09/MF A01 CSCL 21/3

The objective of this program is to identify, validate and assess advantages to the Air Force of using high performance pulsed plasma electric propulsion technology for satellite stationkeeping, attitude control, drag make-up, and solar pressure compensation and to develop pulsed plasma propulsion system/spacecraft integration and design criteria. GRA

N81-12163# Danish Research Center for Applied Electronics, Hoersholm.
RATIONALIZATION OF POWER SUBSYSTEM DESIGN SPECIFICATIONS FOR ESA SPACECRAFT Final Report
Joergen Biegel and Karsten Knud Nielsen Paris ESA 28 Feb. 1980 205 p
(Contract ESA-3780/78-NL-HP(SC))
(ESA-CR(P)-1348) Avail: NTIS HC A10/MF A01

Existing specifications were reviewed, parameters common to all spacecraft power subsystem specifications defined, and a compilation made of standard formats to be used on the GEOS and ECS spacecraft. Two examples show that the standard specification format can be applied to already existing power subsystems and at the same time highlights the weakness of the previous specifications. Author (ESA)

N81-12164# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
EVALUATION OF AN ELECTROTHERMAL HYDRAZINE GAS GENERATOR FOR ATTITUDE CONTROL OF SPACECRAFT Final Report
E. O. Breves Paris ESA 22 Apr. 1980 288 p refs
(Contract ESTEC-2744/76-NL-AK(SC))
(VB-0421018-B; ESA-CR(P)-1357) Avail: NTIS HC A13/MF A01

An electrothermal hydrazine gas generator was life endurance tested. The pre-heat holding temperature of the gas generator was 570 C. Over the six month test period, the gas generator accumulated 8800 operational cycles and decomposed 6 kg of hydrazine. The gas generator performed the filling cycles flawlessly. Each of the ERNO thruster valves accumulated 209,750 pulses and the gas valve accumulated 103,252 pulses. During the test, problems were encountered with the cold gas valves: the recurring slow build up of solid deposits at the outlets, which caused complete blockage of the valves. Removal of this deposit was necessary to enable testing to proceed. Author (ESA)

N81-12165# Societe Europeenne de Propulsion, Vernon (France).
FIELD EMISSION ELECTRIC PROPULSION. DEVELOPMENT AND MANUFACTURING OF A POSITIVE PRESSURE TANK Final Report
J. P. Bugeat, R. Morel, M. Robert, and D. Valentian Paris ESA 1980 212 p
(Contract ESA-3374/77-NL-AK)
(ESA-CR(P)-1365) Avail: NTIS HC A10/MF A01

A cesium positive pressure tank system was studied. A tradeoff study, the test program, and the test facilities are described. The tank system is designed to supply cesium to a field emission thruster, with a capacity sufficient for 5000 hours of operation. A tank was adopted with regulated cesium output pressure, the flow rate being controlled by a valve and a capillary tube acting as a flow limiter. Tank pressurization and a valve actuator depend on a zeolite pressure generator. Three closed loops are required for pressure control, flow rate control, and temperature control. The tank and value use a maximum of existing components. The tank is made with welded bellows and the valve is derived from existing hydrazine values. Tests were performed first with a simulation liquid, and showed the wide range of flow rate allowed (five decades). The cesium tests prove the compatibility of the regulated system with liquid cesium. Author (ESA)

N81-12166# Compagnia Nazionale Aerospaziale S.p.A., Rome (Italy). Dept. of Engineering.
IRIS DERIVED ROCKET (IDR) TO BE USED AS ARIANE 4TH STAGE
A. Buratti and C. Carnebianca Paris ESA Apr. 1980 155 p
(Contract ESA-4030/79-F/DD(SC))
(ESA-CR(P)-1370) Avail: NTIS HC A08/MF A01

IRIS is a solid rocket stage primarily designed as a perigee stage to be flown on the Space Transportation System. Use of an SIRIS derived rocket as a basic block to develop an ARIANE 4th stage is investigated. It is concluded that the IRIS rocket is fundamentally compatible with ARIANE. The IDR may be built up by putting together available qualified hardware and thus it will be comparatively cheap. It is also shown that IDR improves the ARIANE performance in terms of characteristic velocity for payloads below two tons; and ARIANE capability to inject payloads into interplanetary transfer orbits (higher payloads are permissible and a trip to Jupiter is also possible). Author (ESA)

N81-12167# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).
PRODUCTION OF NITROUS OXIDE IN A ROCKET MOTOR EXHAUST
D. E. Jensen London Procurement Executive Ministry of Defense Aug. 1980 18 p refs
(PERME-MEMO-96; BR75265) Avail: NTIS HC A02/MF A01

Predictions are made of concentration of N2O produced within the exhaust of a double base propellant rocket motor. The calculations are made in a three step procedure; (1) chemical equilibrium is assumed in the reaction chamber; (2) the nozzle flow is treated by a method which allows for nonequilibrium chemical effects; and (3) the exhaust structure is computed from knowledge of the exit conditions and external quantities such as missile velocity and altitude. Typical concentrations produced are predicted to be between 10 to the 12th power and 10 to the 13th power molecules per cu cm, some five orders of magnitude below those of CO2, and lower than the characteristic atmospheric level. Author (ESA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N81-12168# Yale Univ., New Haven, Conn. Dept. of Chemistry.
ENERGIES OF ORGANIC COMPOUNDS
K. B. Wiberg 1 Jul. 1980 24 p refs
(Contract DE-AS02-76ER-04060)
(DOE/ER-04060/T1) Avail: NTIS HC A02/MF A01

Automatic reaction calorimeters were developed. Enthalpies of hydration or hydrolysis were determined for polyoxygenated methanes, ketals, acetals, orthoesters, and alkenes. Trifluoroacetolysis of alkenes was carried out. Enthalpies of acetolysis and combustion of cyclopropane derivatives were also determined. Molecular mechanics calculations were carried out for ketones and ketals. Charge distribution in organic compounds were studied. DOE

N81-12169# California Univ., Berkeley. Lawrence Berkeley Lab.
SOFTWARE STANDARDS IN CHEMISTRY
1979 191 p refs Presented at Software Standards in Chemistry Conf., Salt Lake City, 25 Jul. 1979
(LBL-9881; CONF-790779) Avail: NTIS HC A09/MF A01

Standards for machine-independent, modular, and well-documented software suitable for use on large minicomputers are discussed. Portability considerations and standards, documentation and coding standards, machine specification, quantum chemistry software base, quantum chemistry data interfaces, small molecule crystallography, and large molecule crystallography are specifically examined. DOE

N81-12982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRESS IN MATERIALS AND STRUCTURES AT LEWIS RESEARCH CENTER
Thomas K. Glasgow, Richard W. Lauver, Gary R. Halford, and Robert L. Davies *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 43-64 refs (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 11G

24 COMPOSITE MATERIALS

Includes laminates.

N81-12170 Rolls-Royce Ltd., Derby (England).
THE USE OF RESIN SYSTEMS IN THE MODERN AEROSPACE FOUNDRY
J. C. Hogg 1980 49 p refs
(PNR-90014) Avail: NTIS HC A03

The manufacture, and applications of acid catalysts required for polymerization of the SAND/Resin system, furfuryl alcohol/resorcinol and urea fromaldelyde/ furfuryl alcohol resin systems for high integrity casting of light alloys are described. The problems derived from fumes evolved during mixing and sand curing are discussed. The criteria to be used by the resin producers to obtain satisfactory resin systems for aerospace molding applications are listed. Author (ESA)

N81-12171*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LAMINATES AND REINFORCED METALS
C. C. Chamis Oct. 1980 47 p refs
(NASA-TM-81591; E-570) Avail: NTIS HC A03/MF A01 CSCL 11D

A selective review is presented of the state of the art of metallic laminates and fiber reinforced metals called metallic matrix laminates (MMLs). Design and analysis procedures that are used for, and typical structural components that have been made from MMLs are emphasized. Selected MMLs, constituent materials, typical material properties and fabrication procedures are briefly described, including hybrids and superhybrids. Advantages, disadvantages, and special considerations required during design, analysis, and fabrication of MMLs are examined. Tabular and graphical data are included to illustrate key aspects of MMLs. Appropriate references are cited to provide a selective bibliography of a rapidly expanding and very promising research and development field. J.M.S.

N81-12172*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
CONTACT LAW AND IMPACT RESPONSES OF LAMINATED COMPOSITES Interim Report
C. T. Sun and S. H. Yang Feb. 1980 112 p refs
(Grant NsG-3185)
(NASA-CR-159884; CML-80-1) Avail: NTIS HC A06/MF A01 CSCL 11D

Static identation tests were performed to determine the law of contact between a steel ball and glass/epoxy and graphite/epoxy laminated composites. For both composites the power law with an index of 1.5 was found to be adequate for the loading curve. Substantial permanent deformations were noted after the unloading. A high order beam finite element was used to compute the dynamic contact force and response of the laminated composite subjected to the impact of an elastic sphere. This program can be used with either the classical Hertzian contact law or the measured contact law. A simple method is introduced for estimating the contact force and contact duration in elastic impacts. Author

N81-12173*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPERIMENTAL INVESTIGATION OF GRAPHITE/POLYIMIDE SANDWICH PANELS IN EDGEWISE COMPRESSION
Charles J. Camarda Oct. 1980 145 p refs
(NASA-TM-81895) Avail: NTIS HC A07/MF A01 CSCL 11D

The local and general buckling behavior of graphite/polyimide sandwich panels simply supported along all four edges and loaded in uniaxial edgewise compression was investigated. Material properties of adhesive and facings were determined from flatwise tension and sandwich beam flexure tests. Tensile and compressive material properties of the facings were determined at 116, R.T., and 589 K (-250, R.T., and 600 F) using the sandwich beam flexure test method. Results indicate that Gr/PI is a usable structural material for short term use at temperatures as high as 589 K (600 F). Buckling specimens were 30.5 X 33.0 cm (12 x 13 in.), had quasi-isotropic symmetric facings and a glass/polyimide honeycomb core. Core thicknesses varied and three panels of each thickness were tested in edgewise compression at room temperature to investigate failure modes and corresponding buckling formulas. Specimens 0.635 cm (0.25 in.) thick failed by overall buckling at loads close to the analytically predicted buckling load; all other panels failed by face wrinkling. Results of the winkling tests indicate that several buckling formulas were unconservative and therefore not suitable

for design purposes; recommended wrinkling equations are presented. A.R.H.

N81-12174*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PROCESS FOR PREPARING HIGH TEMPERATURE POLYIMIDE FILM LAMINATES Patent Application
Anne K. St.Clair and Terry L. St.Clair, inventors (to NASA) Filed 22 Sep. 1980 17 p
(NASA-Case-LAR-12742-1; US-Patent-Appl-SN-189234) Avail: NTIS HC A02/MF A01 CSCL 11D

A process for fabricating large area void-free polyimide laminate structures wherein multiple ply polyimide film laminates may be constructed without decreasing the individual film strength is described. Layers of metal foil may be laminated between polyimide film layers to yield a flexible high temperature resistant structure having capabilities for use as flexible electric circuits in aerospace applications. NASA

N81-12175*# California Univ., Berkeley.
METHOD FOR PRODUCING THIN SHEETS OF PROTON-SENSITIVE CR-39 PLASTIC TRACK DETECTORS Final Report, 16 Mar. 1979 - 15 Mar. 1980
K. Kinoshita Apr. 1980 8 p
(Contract NAS5-25453)
(NASA-CR-160037; SSL-Ser-21-Issue-9) Avail: NTIS HC A02/MF A01 CSCL 11D

Procedures for fabricating large sheets of CR-39 with uniform chemical reactivity and sensitivity and which retain a clear, smooth surface after prolonged etching were investigated. Very thin sheets for certain Spacelab applications were fabricated. Author

N81-12176# Boeing Vertol Co., Philadelphia, Pa.
CONVEYORIZED RADIO FREQUENCY CURE OF EPOXY GLASS COMPOSITES Final Report, 19 Jan. 1979 - 19 Feb. 1980
Lawrence C. Ritter May 1980 322 p refs
(Contract DAAG49-79-C-0009)
(AD-A089728; USAAVRADCOM-TR-80-F-16) Avail: NTIS HC A14/MF A01 CSCL 13/8

The purpose of this work is to develop a dielectric heating capability for curing fiber reinforced composite structure. The specific objectives were to develop optimum radio frequency (rf) cure cycles for resin/fiber composites, establish process parameters relative to feed rate, rf power levels, electrode spacing, and material thickness variations. Present manufacturing technology for curing epoxy/fiber composite structure involves the use of large energy consuming facilities (ovens, autoclaves, resistant or radiant heaters, etc.) which entail costly flow times. The use of direct dielectric heating can provide, in some instances, a cost effective alternate curing method. It has been shown that a cost savings of 75 percent can be realized by the use of radio frequency curing over conventional curing by conduction heating. In the basic principles applied to cure by dielectric heating, an alternating electric field causes oscillatory displacements in the charged components of the dielectric, the energy for motion being absorbed from the electric field. The energy absorbed by the molecules is translated into rotational kinetic energy of the entire molecule, resulting in a temperature increase. GRA

N81-12177# Army Materials and Mechanics Research Center, Watertown, Mass.
LASER INTERACTION WITH TBR MATERIALS
Janet S. Perkins Jun. 1980 15 p refs
(AD-A090429) Avail: NTIS HC A02/MF A01 CSCL 11/4

In a number of areas the Army has need for high temperature, heat shielding materials that retain shape and structural integrity in severe thermal environments. Some applications are the throat of a jet engine or the interior of a rocket combustion chamber. We have been examining the response of a number of composite materials to a high-energy-flux environment using a welding laser instead of the arc furnaces of earlier studies. A laser is a clean, well-defined energy source. If used with an air stream or an exhaust system to remove pyrolytic products and debris, we can isolate the action of energy flux from secondary effects and reduce scatter in data. GRA

N81-12178# Bendix Corp., Kansas City, Mo.
SIMULTANEOUS MEASUREMENT OF MULTILAYERED COMPOSITES
R. V. Heckman Jun. 1980 38 p refs Sponsored by DOE
(BDX-613-2407) Avail: NTIS HC A03/MF A01

A theoretical treatment of the eddy current problem involving a two layered conductor laminate is presented for a rectangular cross section coil. Experimental eddy current measurements indicating that a frequency of 1.5 MHz should be used to measure a 6.45 micrometers aluminum conductor, a 0.5 MHz frequency should be used to measure a 50.8 micrometers aluminum conductor, and a frequency of SO MHz should be used to measure lift off. The schematic and the basic design of a two frequency microprocessor controlled eddy current system is also presented. R.C.T.

N81-12179# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
RESIDUAL STRENGTH OF MULTI-PLY CARBON/EPOXY KEVLAR-CARBON/EPOXY NOTCHED LAMINATES
W. G. J. tHart Paris Association Aeronautique et Astronautique de France Apr. 1979 37 p refs Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(AAAF-NT-79-34; ISBN-2-7170-0582-X) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

The residual strength of composite laminates was investigated, including the influence of prior fatigue loading. The laminates were multiply carbon/epoxy and combinations of carbon/epoxy with face sheets of Kevlar fabric or aluminum. Residual strength tests were carried out on 40 mn wide specimens provided with central holes or sawcut slits. For some laminates, delamination processes preceding failure were examined with the aid of strain gauge measurements. The data were compared with theoretical failure criteria. A comparison between the residual strength behavior of composite laminates and conventional aluminum sheet alloys was made. Specimens containing central holes were fatigue loaded before residual strength testing. The cyclic loading occurred at a maximum stress level of about 40 percent of the unnotched material strength for about 10,000 cycles. Author (ESA)

N81-12180# Rolls-Royce Ltd., Derby (England).
THE DEVELOPMENT OF THE COMPOSITE MATERIAL ENGINE NACELLE
H. X. Bennett Paris Association Aeronautique et Astronautique de France 1979 27 p refs Presented at 14th. Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(AAAF-NT-79-38; ISBN-2-7170-0586-2) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 22 (France and EEC) FF 27 (others)

The manufacturing techniques for composite carbon fiber (CFC) engine nacelles are discussed and the overall cost and weight results examined. The design and construction of the four components of a nose cowl are described, where a 25 to 29 percent weight reduction was obtained. Alternative manufacturing methods are compared. Automated production of a nose cowl in CFC would result in a cost reduction of 20 percent in spite of a raw materail cost ratio of ten (CFC to aluminum).
Author (ESA)

N81-12181# System Development Corp., Santa Monica, Calif.
TESTING OF COMPOSITE STRUCTURES
G. E. Mueller Paris Association Aeronautique et Astronautique de France 1979 23 p refs Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(AAAF-NT-79-41; ISBN-2-7170-0589-7) Avail: NTIS HC A02/MF A01; CEDOCAR, Paris FF 22 (France and EEC) FF 27 (others)

A critical analysis of published reports on testing of composite structures is presented, centered on the reliability of nondestructive testing procedures. It is concluded that no combination of current nondestructive test techniques can ensure airworthiness today. Author (ESA)

N81-12182# Societe Nationale Industrielle Aerospatiale, Marignane (France.)
IMPACT OF MODERN MATERIALS ON THE DEVELOPMENT OF ROTATING AIRFOIL EQUIPMENT [IMPACTS DES MATERIAUX MODERNES SUR LE DEVELOPPEMENT DES APPAREILS A VOILURES TOURNANTES]
G. Petit and F. d'Ambra Paris Association Aeronautique et Astronautique de France 1979 36 p In FRENCH
(AAAF-NT-79-43; ISBN-2-7170-0591-9) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

Improvements in nonmetallic materials used in helicopter construction are presented. The specific uses of these materials for the different components of helicopters are described. Emphasis is given to the applications of modern composites. The financial, technical and safety aspects associated with the use of these materials are discussed together with some specific problems, e.g., maintenance. A 6 to 8 ton class tactical helicopter is treated as an example. Author (ESA)

N81-12183# Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France). Etudes Structures.
MIRAGE 2000 AND MIRAGE 4000 FIBER STRUCTURES [STRUCTURES FIBRES SUR MIRAGE 2000 ET MIRAGE 4000]
Marcel Peyrony Paris Association Aeronautique et Astronautique de France 1979 36 p In FRENCH Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(AAAF-NT-79-44; ISBN-2-7170-0592-7) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

The applications of modern fiber materials for various components are discussed. The criteria determining whether glues or mechanical fixation are to be employed are presented. Structural behavior, optimization, and test results are given. Some of the techniques used are extensions of existing methods. Nondestructive testing is described. The weights of various components are tabulated. Author (ESA)

N81-12184# Centre National d'Etudes Spatiales, Toulouse (France).
COMPOSITE MATERIALS APPLIED TO AEROSPACE STRUCTURES
J. N. Giraudbit Paris Association Aeronautique et Astronautique de France 1979 51 p In FRENCH; ENGLISH summary Presented at 14th. Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(AAAF-NT-79-45; ISBN-2-7170-0593-5) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

The specific advantages of the use of carbon fiber reinforced plastics (CFRP) in aerospace structures such as antenna systems and telescope structures are reviewed. In addition to good mechanical performance low or even zero coefficient of thermal expansion is a practical necessity in the design of these components. The manufacturing processes are discussed. Practical examples of the applications of CFRP in the Spot, Intelsat 5, MAROTS and LST satellites are presented. Author (ESA)

N81-12185# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
MAXIMIZING THE INTERSECTION DENSITY OF FIBER PROCESSES
Olav Kallenberg 1980 8 p refs
(CTH-Math-1980-4) Avail: NTIS HC A02/MF A01

The problem of maximizing the fiber intersection density in three dimensions is analyzed. The fibers are represented by infinite circular cylinders whose axes form a stationary Poisson line process in R cubed. A theorem is proved stating that for the above process, and for a given mass density, the largest intersection density is attained when and only when the distribution of directions is uniform. It is shown that a convenient practical choice is the distribution of the fibers in three orthogonal directions; the uniform distribution yields an improvement over this by a factor of only 1.18. Author (ESA)

N81-12186# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
RESIDUAL STRENGTH OF MULTI-PLY CARBON/EPOXY AND KEVLAR-CARBON/EPOXY NOTCHED LAMINATES
W. G. J. tHart Apr. 1979 37 p refs Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979
(NLR-MP-79016-U) Avail: NTIS HC A03/MF A01

Notched samples of carbon/epoxy and Kevlar-carbon/epoxy laminates were tested. In the residual strength investigation 40 mm wide specimens provided with central holes or sawcut slits were used. Results were compared with theoretical failure criterion. Some specimens containing holes were fatigue loaded before residual strength testing to determine the influence of fatigue damage on the residual strength. It was concluded that composite laminates are very notch sensitive, but their fatigue properties are superior to those of 2024OT3 and 7075-T6. The influence of holes and cracks of equal sizes on the notched strength is almost identical unless delamination near the discontinuity can occur. Residual strength behavior is reasonably well predicted by theory, and fatigue loading at a stress level of 200 to 300 MPA (R = 0.1) for 500,000 cycles was not detrimental to residual strength. Author (ESA)

N81-12187# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
INVESTIGATION OF IMPACT DAMAGE IN SANDWICH PANELS WITH FACE SHEETS OF COMPOSITE MATERIALS
W. G. J. tHart and K. A. VanderSijde Feb. 1979 66 p ref In DUTCH; ENGLISH summary
(Contract NIVR-1744)
(NLR-TR-79011-U) Avail: NTIS HC A04/MF A01

An impact damage investigation was performed on sandwich panels of Nomex honeycomb and face sheets of composite laminates. Impact damage was made with drop weights. The nature and extent of the damage was examined with nondestructive techniques including holography and X-rays. Author (ESA)

N81-12984*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-LUBRICATING COMPOSITE MATERIALS
Harold E. Sliney *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 75-95
(For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N81-12188# Bayern-Chemie G.m.b.H., Ottobrunn (West Germany).
KINETICS OF IONIZATION IN NaCl-CONTAMINATED ARGON
C. P. Schneider, G. Hahne (Hochschule der Bundeswehr, Munich), and H. H. Macke 11 Jul. 1980 21 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal on Mar. 1981
(LOG-J6857) Avail: NTIS HC A02/MF A01

The investigation consisted of two parts. The first part was an exploration of methods of obtaining a very clean shock-tube. The cleaning method decided upon comprised glass bead penning of the shock-tube walls, followed by multiple flushing of the tube; this method, however, left a practically irreducible and non-negligible residue of sodium chloride vapor in the tube. The second part of the investigation, accordingly, consisted of the theoretical simulation of the observed time dependence of the electron density, the electron temperature, and the emitted sodium D light, in shock-heated argon contaminated by a small amount

of sodium chloride vapor. It was found that accounting for the effects of contaminants required important revisions in rate constants for pure argon from previously determined values.
Author

N81-12189# Applied Technology Corp., Norman, Okla.
EFFECTIVENESS OF FIRE CONTROL AGENTS ON CHEMICAL FIRES. PHASE 1: TEST METHODOLOGY AND BASELINE HEXANE TESTS Final Report
J. R. Welker, W. E. Martinsen, D. W. Johnson, and J. N. Ice Jun. 1980 150 p refs
(Contract DOT-CG-42355-A)
(AD-A089585; ATC-103-FR; USCG-D-50-80) Avail: NTIS HC A07/MF A01 CSCL 13/12

A basic test method for comparing relative effectiveness of fire control agents on fires from liquid chemicals was set and modified through developmental tests. The methodology was then demonstrated in a test series intended to produce baseline data for comparison with future test data using other chemicals as fuels. Fuel for the baseline test series was high purity hexane. Tests were run in concrete pits with and without sheet steel wall linings and with and without steel obstructions. Pit (fuel) surface areas were 25, 100, 400 and 1600 sq ft. Foam fire control agents used were low expansion protein, AFFF, and alcohol and a saltwater high expansion foam. Dry chemical agents were used in the three smaller pit sizes and were sodium bicarbonate and potassium bicarbonate, and a urea-potassium bicarbonate reaction product. Agents were applied through fixed systems, with a few manual tests for comparison. Data collected include burning rates; fuel, wall and obstruction temperatures; radiant fluxes; agent flow rates and nozzle pressures; preburn, control, and extinguishment times; and meteorological information. Times were taken by instrumentation or observation and stopwatch. Tentatively, the best data element for comparison appears to be a plot of application rate versus control time for foams and versus extinguishment time for dry chemical agents. Future tests should establish scaling parameters to allow use of smaller surface areas for the comparative effectiveness tests. GRA

N81-12190# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
FAST DEFLAGRATION WAVES Interim Report
D. S. Stewart and G. S. S. Ludford Jul. 1980 45 p refs
(Contract DAAG29-79-C-0121)
(AD-A090776; ARO-15882.21-M; TR-116) Avail: NTIS HC A03/MF A01 CSCL 21/2

The analysis of steady plane deflagration waves invariably starts with the combustion approximation where it is assumed that the Mach number, i.e., the flame speed divided by a characteristic sound speed, is vanishingly small. The momentum equation then implies that the pressure is nearly constant while the thermal and mechanical descriptions of the wave decouple, so that the task of solving for the structure is greatly simplified. Even then explicit formulas can only be obtained in the limit of large activation energy. We are currently interested in describing, by means of activation-energy asymptotics as far as possible, the transition from deflagration to detonation in gases. One of the first steps in such a theory is to analyze deflagration waves whose Mach numbers are not vanishingly small. Pressure variations cannot be neglected and hence the momentum equation must be retained in the description of the structure. We will show, in the present paper, that the method of activation-energy asymptotics gives an analytic description of these fast deflagrations, i.e., deflagrations travelling at speeds greater than those justifying the use of the combustion approximation. In addition we examine the limit of vanishingly small Mach number to shed light on the nature of the combustion approximation. GRA

N81-12191# Monsanto Research Corp., Dayton, Ohio.
TRACE CHEMICAL ANALYSIS METHODOLOGY Final Report, 5 Feb. 1975 - 15 Mar. 1980
William J. Hillan, Joseph J. Brooks, Thomas G. Duffy, Mark T. Winiger, and William D. Ross Apr. 1980 256 p refs
(Contract F33615-75-C-1130)
(AD-A090762; MRC-DA-934) Avail: NTIS HC A12/MF A01 CSCL 07/4

A method was developed for the analysis of aqueous nitrates and nitrites. In this method, the sample is treated with benzene, hydrogen peroxide (for nitrite ion analysis), and sulfuric acid to produce nitrobenzene which is then detected by electron capture gas chromatography. This analytical method was adapted to determine oxides of nitrogen in air. A system to sample and analyze the hydrocarbon portion of jet engine exhaust to assess its environmental consequences was evaluated. Exhaust samples were collected and analyzed from five jet fuels and isooctane. The samples were collected on a combination sorbent trap packed with Tenax GC and Carbosieve B, then desorbed into a gas chromatograph. GRA

N81-12192# Science Applications, Inc., Canoga Park, Calif. Combustion Dynamics and Propulsion Technology Div.
MIXING AND COMBUSTION IN HIGH SPEED AIR FLOWS Final Report, Apr. 1977 - May 1980
P. T. Harsha and R. B. Edelman Jul. 1980 69 p refs
(Contract F49620-77-C-0044; AF Proj. 2308)
(AD-A090536; SAI-80-020-CP; AFOSR-80-1005TR) Avail: NTIS HC A04/MF A01 CSCL 21/5

The development and application of a modular model for the prediction of the performance of sudden expansion burners as a function of the controllable parameters relevant to combustor design is described. The model is based on a concept in which the recirculation zone, treated as a stirred reactor, is coupled to a parabolic boundary layer formulation for the flow outside the recirculation zone. Hydrocarbon oxidation kinetics and turbulent kinetic energy models are employed in the model development. In addition to the parabolic-flow and stirred reactor elements, a module representing the fuel injection process has been developed. Results of the application of the modular model to the analysis of cold-flow and reacting-flow dump combustor experimental data are described. GRA

N81-12193# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
THE DECOMPOSITION OF N2O ON Ni (110)
Radhesyam Sau and John B. Hudson 15 Sep. 1980 23 p refs
(Contract N00014-75-C-0730)
(AD-A090552; TR-9) Avail: NTIS HC A02/MF A01 CSCL 07/4

The catalytic decomposition of N2O to yield N2 gas and adsorbed oxygen has been studied on the Ni(110) surface over the temperature range from 323 to 873 K. The combination of Auger electron spectroscopy and molecular beam mass spectrometry has been used to determine the overall rates of production of adsorbed oxygen and N2 gas, and the scattering behavior of unreacted N2O. These data have been analysed to determine the single collision reaction probability as a function of surface temperature and adsorbed oxygen coverage. The reaction precedes from a zero-coverage reaction probability of from 0.97 and 0.52 depending on temperature, to zero reaction probability at an adsorbed oxygen coverage of 1/3 ML. The behavior at partial oxygen coverage is strongly influenced by the presence of a molecular precursor species, especially at low temperatures.GRA

N81-12194# Army Missile Command, Redstone Arsenal, Ala. Propulsion Directorate.
THREE DIMENSIONAL FINITE ELEMENT COMBUSTION INSTABILITY ANALYSIS
Robert M. Hackett Jun. 1980 14 p refs
(AD-A090396) Avail: NTIS HC A02/MF A01 CSCL 21/2

The NASTRAN finite element analysis is axisymmetric and approximates the effect of radial slots on the cavity acoustics. As long as the slot width is relatively narrow, the approximation provides an accurate model of the cavity acoustic response, but as the slot width increases, the accuracy diminishes. The NASTRAN option as used in the standardized method does not provide for the coupling of the vibratory response of the solid propellant grain to that of the acoustic cavity and hence does not provide a means of evaluating the damping of the acoustic oscillations by the propellant grain response. GRA

N81-12195# Beet Sugar Development Foundation, Fort Collins, Colo.
EVAPORATION BY MECHANICAL VAPOR RECOMPRESSION Technical Progress Report, 1 Apr. - 30 Jun. 1980
Clair H. Iverson and Glenn E. Coury 30 Jun. 1980 81 p

(Contract DE-AC03-79CS-40208)
(BSDF-38-3Q-80) Avail: NTIS HC A05/MF A01

The expected performance and estimated capital cost of two schemes are presented for the application of mechanical vapor recompression to a conventional, low pressure, five effect juice evaporator in a beet sugar factory. Due to the constraints of the existing system and the desire to make the most effective use of the capital investment, the recommendation is to install Scheme 'B'. This selection recognizes the inability of the falling film evaporator to respond to rapid and frequent changes in capacity, and upon the need to raise the first effect vapor pressure to allow utilization of first effect bleed vapor to boil the white sugar crystallization pan. The recommended installation, Scheme 'B', is predicted to reduce the hourly steam consumption by up to 10,477/hr for an annual fuel savings of $126,800 on today's fuel cost at the Greeley Factory of The Great Western Sugar Company. This represents a 9.35% reduction in the amount of steam generated during the base year of 1978-9. The estimated capital cost of the installation is $825,000. R.C.T.

N81-12196# Midwest Research Inst., Golden, Colo.
RESEARCH INTO THE PYROLYSIS OF PURE CELLULOSE, LIGNIN, AND BIRCH WOOD FLOUR IN THE CHINA LAKE ENTRAINED-FLOW REACTOR
J. Diebold Jun. 1980 41 p refs
(Contract DE-AC02-76CH-00178)
(SERI/TR-332-586) Avail: NTIS HC A03/MF A01

It was determined that the cellulose and wood flour do pyrolyze to produce primarily gaseous products containing significant amounts of ethylene and other useful hydrocarbons. During attempts to pyrolyze powdered lignin, the material melted and bubbled to block the reactor entrance. The pure cellulose and wood flour produced C2 + yields of 12% to 14% by weight, which were less than yields from an organic feedstock derived from processed municipal trash. The char yields were 0.1% by weight from cellulose and 1.5% from birch wood flour one to two orders of magnitude less than were produced from the trash derived feedstock. In scanning electron microscope photographs, most of the wood flour char had a sintered and agglomerated appearance, although some particles retained the gross cell characteristics of the wood flour. The appearance of the char particles indicated that the material had once been molten and possibly vapor before it formed spheroidal particles about 1 micron m diameter which agglomerated to form larger char particles. DOE

N81-12197# University of Western Michigan, Kalamazoo. Dept. of Chemistry.
FUNDAMENTALS OF NITRIC OXIDE FORMATION IN FOSSIL FUEL COMBUSTION Progress Report, 29 Mar. - 28 Jun. 1980
Thomas Houser and Michael McCarville Jul. 1980 11 p refs
(Contract DE-AC01-76ET-10593)
(FE-2018-17) Avail: NTIS HC A02/MF A01

Two sets of data were obtained: a series of determinations of the rates of NO and/or HCN formation from the oxidation of pyridine at 950 C, and a series of measurements of HCN formation (and a few of NH3 and NO) from pyridine oxidation at 675 to 775 C to determine its rate of formation and to recheck the previous reactant consumption rate data. At 950 C under fuel rich conditions no NO and very little NH3 and N2 were formed. The only volatile, nitrogen containing product formed was HCN and its yield was time independent. At fuel lean mixture ratios and low initial concentrations, molecular nitrogen was produced with a little NO as the only other significant nitrogen containing product. At the higher initial concentrations NO was formed in large yields which were dependent on contact time, first increasing, then decreasing. DOE

N81-12198# Ford Motor Co., Dearborn, Mich. Fuels and Lubricants Dept.
HC QUENCH LAYER FORMATION IN COMBUSTION PROCESSES Technical Progress Report, Jan. - Apr. 1980
G. A. Lavoie Jun. 1980 17 p
(Contract DE-AC03-79ET-15303)
(DOE/ET-15303/T4) Avail: NTIS HC A02/MF A01

Wall quenching and other processes responsible for surface generated hydrocarbons in combustion under engine-like conditions were investigated. The effects of turbulence on the evolution of hydrocarbons was studied. The work was divided into three tasks: combustion bomb experiments to measure the effect of turbulence on the chemical species near the cold surface; combustion bomb experiments using a similar turbulence generating device, to fully characterize the flow and turbulence in the vicinity of the quenching surface; and an analytical study to characterize fluid mechanical scales of interest in the boundary layer and to find an analytical solution to describe the evolution of the layer. An analysis leading to a simplified model for the turbulent quench layer was obtained. DOE

N81-12199# Ford Motor Co., Dearborn, Mich. Fuels and Lubricants Dept.
HC QUENCH LAYER FORMATION IN COMBUSTION PROCESSES Technical Progress Report, Sep. - Dec. 1979
G. A. Lavoie Feb. 1980 9 p refs
(Contract DE-AC03-79ET-15303)
(DOE/ET-15303/T3) Avail: NTIS HC A02/MF A01

Wall quenching and other processes responsible for surface generated hydrocarbons in combustion under engine-like conditions were investigated. The effects of turbulence on the evolution of hydrocarbons was studied. The work was divided into three tasks: combustion bomb experiments to measure the effect of turbulence on the chemical species near the cold surface; combustion bomb experiments, using a similar turbulence gernerating device, to fully characterize the flow and turbulence in the vicinity of the quenching surface, and an analytical study to characterize fluid mechanical scales of interest in the boundary layer and to find an analytical solution to describe the evolution of the layer. DOE

N81-12200# Tennessee Univ., Knoxville. Dept. of Physics.
VACUUM ULTRAVIOLET ELECTRONIC PROPERTIES OF LIQUIDS Annual Progress Report, 1 Nov. 1979 - 31 Oct. 1980
Linda R. Painter 1980 20 p refs
(Contract DE-AS05-76EV-03861)
(DOE/EV-03861/T1) Avail: NTIS HC A02/MF A01

Optical and dielectric properties of hexamethyl-phosphoric triamide, photoemission from UV irradiated liquids, photon and photoelectron mean free paths in liquids; and properties of Kapton films were studied. Ultraviolet transmission of polycyclic organic molecules was also studied. DOE

N81-12201# Department of Energy, Washington, D. C. Office of Health and Environmental Research.
CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM. A COMPREHENSIVE PLAN. PART 1: THE GLOBAL CARBON CYCLE AND CLIMATIC EFFECTS OF INCREASING CARBON DIOXIDE
Aug. 1980 97 p refs
(DOE/EV-0094) Avail: NTIS HC A05/MF A01

Ideas and strategies for carbon cycle research, and expansion of the scope of research on climatic responses to increasing atmospheric concentrations of CO2 are discussed. DOE

N81-12202# California Univ., Berkeley. Lawrence Berkeley Lab.
SURFACE AND CATALYSIS SCIENCE IN THE MATERIALS AND MOLECULAR RESEARCH DIVISION
1980 69 p
(Contract W-7405-eng-48)
(DOE/TIC-11225) Avail: NTIS HC A04/MF A01

Surface science studies are detailed. Subject areas include: structure of surfaces and adsorbed monolayers; reduction and oxidation of surfaces; catalytic chemistry; and structure of interfaces and thin films. DOE

N81-12203# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
REGENERATIVE PROCESS FOR DESULFURIZATION OF HIGH TEMPERATURE COMBUSTION AND FUEL GASES
A. S. Albanese, D. S. Sethi, G. Farber, J. Pruzansky, and F. B. Kainz Mar. 1980 24 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51223) Avail: NTIS HC A02/MF A01

The characteristics of Portland Type III cement (PC III) as a

potential sorbent for use in a regenerative process for desulfurization of coal in fluidized-bed combustion were examined. The sulfation rates for PC III + 5% amorphous SiO2 at temperatures between 860 C and 1100 C and at 1 atm were studied thermogravimetrically, using a simulated combustion gas mixture containing 0.25% SO2. The sulfation rates were found to be idenpendent of temperature between 950 C and 1050 C. The isothermal regeneration with a mixture consisting of 5% CO, 15% CO2 and the balance N2, in the above temperature interval of 100 C approached an equilibrium value of over 90% within thirty minutes. Sulfation/regeneration efficiency did not decrease with cycling and was unaffected by additives introduced to increase the porosity and/or conversion of free CaO in PC III to silicates which are known to be more regenerative than CaSO4. Pressurized TGA experiments within the optimum sulfation temperature range were conducted at 5 and 10 atm to establish the viability of this sorbent for pressurized fluidized-bed combustion use. Author

N81-12204# Argonne National Lab., Ill. Chemical Engineering Div.

SAMPLING AND ANALYSIS OF HYDROCARBONS IN COMBUSTION GASES Quarterly Report, Apr. - Jun. 1980

Irving Johnson, K. M. Myles, and A. A. Siczek Jul. 1980 14 p refs

(Contract W-31-109-eng-38)

(ANL/CEN/FE-80-11) Avail: NTIS HC A02/MF A01

A methodology for the chemical analysis of ultratrace levels of polycyclic organic compounds in the flue gases from fluizied bed combustors is discussed. A brief review of current analytical methods is made. Alternative methods, which have the potential for real time analysis, are studied. Two methods, atmospheric pressure chemical ionization followed by mass spectrometry and dual mass spectrometry, appear promising. M.G.

N81-12205# Bendix Corp., Kansas City, Mo.

X-RAY FLUORESCENCE ANALYSIS OF METAL CONCENTRATION IN AN ALLOY ELECTROPLATING BATH

R. A. Hines Jun. 1980 34 p refs Sponsored by DOE

(BDX-613-2411) Avail: NTIS HC A03/MF A01

A system based on X-ray fluorescence was developed for determining the metal concentration in an alloy electroforming bath. A radioactive source supplied the excitation energy to a bath sample, and the intensities of the characteristic X-ray spectrum for gold and copper were measured using a solid state detector and a multi-channel analyzer. A programmable calculator read the spectrum and converted the data to metal concentrations. The basic hardware system was developed previously for alloy analysis, and only the addition of a heated sample holder was required for this work. After developing a suitable algorithm for data reduction, the calculator was programmed to reduce the data. Twenty-one calibration bath samples with various gold and copper concentrations were carefully prepared. The minimum solution depth required in the sample holder was experimentally determined. Calibration standards were placed in the sample holder, and 500 second counts were used to collect the X-ray spectrum. The K alpha radiation from copper and the La radiation from gold were used. R.C.T.

N81-12206# Bendix Corp., Kansas City, Mo.

THIN FILM GOLD ETCHANT FORMULATION AND RINSE REMOVAL Final Report

M. K. Raut Jul. 1980 34 p refs

(Contract DE-AC04-76DP-00613)

(BDX-613-2393) Avail: NTIS HC A03/MF A01

Thin film production yield problems resulting from metallization adhesion failures, corrosion of resistors, and thermocompression bond delaminations indicated that improved understanding and control of chemical solutions used in photolighography were needed. The formulation and operating limits of the potassium iodide/iodine solution used to etch the gold were evaluated and redefined. Tests were conducted which showed that increasing the concentration of potassium iodide for a fixed concentration of iodine increases the rate of gold etching. The gold etchant formulation was changed so that the initial value of normality of iodine is always 1.0 and the initial specific gravity is 1.250 10.005. A limit was placed on specific gravity so that the etchant is discarded when the specific gravity increases by 0.020. The rinsing process used to remove residual gold etchant was evaluated with respect to type of rinsing solution, temperature of rinsing solution, flow rate of rinsing solution, and rinse time. Methyl alcohol was shown to rinse the etchant from the substrates in about 10 seconds compared to 10 seconds compared to 20 seconds for deionized water. Author

N81-12207# European Space Agency, Paris (France).

CHEMICAL REACTIONS IN TURBULENT MEDIUM Ph.D. Thesis - Pierre et Marie Curie Univ.

Roland Borghi Oct. 1980 175 p refs Transl. into ENGLISH of "Reactions Chim. en Milieu Turbulent", Rept. ONERA-NT-1979-2 Onera, Paris 1979 Original report in FRENCH previously announced as N80-23412

(ESA-TT-638; ONERA-NT-1979-2) Avail: NTIS HC A08/MF A01

Different aspects of reactive turbulent flows are discussed including the turbulent diffusion of possibly reactive species in a medium with variable density, the analysis of fluctuations of species concentrations, and the calculation of the mean reaction rate. Using partial differential equations for the moments of fluctuations together with particle closure assumptions, solutions for these problems are proposed. Two applications are highlighted. The first deals with the development of a high velocity premixed flame in a constant area duct. The second is devoted to the combustion in a fixed volume burner. The influence of such small scale disturbance on the rate of energy release and on the production of pollutant species NOx is discussed.

Author (ESA)

N81-12208# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.

FLAMMABILITY TESTING

Paris ESA Sep. 1980 23 p refs

(ESA-PSS-26/QRM-21T-ESTEC-ISS-2; ISSN-0379-Y059) Avail: NTIS HC A02/MF A01

The equipment and procedures to be employed in initial screening tests of the flammability properties of materials intended for use in a manned spacecraft vehicle are described. Some previous methods which are adopted in the specification are listed. The test methods include the critical oxygen index, downward propagation test, determination of the flash and fire point, electrical wire insulation and accessory flammability test, and the configuration test. Author (ESA)

N81-13002# Karlsruhe Univ. (West Germany). Engler-Bunte-Institut.

CORRELATION MEASUREMENT OF VELOCITY AND TEMPERATURE FLUCTUATIONS IN A FREE JET DIFFUSION FLAME

V. Wittmer and R. Guenther *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 8 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

N81-13003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

VELOCITY AND TURBULENCE MEASUREMENTS IN TURBULENT FLAMES USING THE L2F TECHNIQUE

H. Eickhoff and R. Schodl *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

N81-13006# Imperial Coll. of Science and Technology, London (England).

VELOCITY AND TEMPERATURE MEASUREMENTS IN A PREMIXED FLAME WITHIN AN AXISYMMETRIC COMBUSTOR

A. M. K. P. Taylor and J. H. Whitelaw *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 11 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

N81-13008# Poitiers Univ. (France). Lab. d'Energetique et de Detonique.

THE APPLICATION OF UV SPECTROSCOPY TO THE QUALTITATIVE ANALYSIS OF NITROGEN OXIDE [APPLI-

CATION DE LA SPECTROSCOPIE U. V. AU DOSAGE DE LOXYDE NITRIQUE]
J. Ph. Durand and J. C. Bellet *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 10 p refs In FRENCH (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13009# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIAGNOSING COMBUSTION BY D.R.A.S.C. [DIAGNOSTICS DES COMBUSTIONS PAR D.R.A.S.C.]
B. Attal, M. Pealat, and J. P. Taran *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 16 p refs In FRENCH (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13010*# United Technologies Research Center, East Hartford, Conn.
INVESTIGATIONS OF COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) FOR PRACTICAL COMBUSTION DIAGNOSTICS
Alan C. Eckbreith, Robert C. Hall, and John A. Shirley *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 14 p refs Sponsored in part by NASA and EPA (For primary document see N81-12993 03-99)
(Proj. SQUID)
Avail: NTIS HC A13/MF A01

N81-13011# General Electric Co., Schenectady, N. Y. Corp. Research and Development.
THE STUDY OF TURBULENT DIFFUSION FLAMES: MODELING NEEDS AND EXPERIMENTAL LIGHT SCATTERING CAPABILITIES
M. Ladd and R. M. C. So *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 18 p refs Sponsored in part by DOE and AFOSR (For primary document see N81-12993 03-99)
(Proj. SQUID)
Avail: NTIS HC A13/MF A01

N81-13012# Consiglio Nazionale delle Ricerche, Milan (Italy).
FLAME TEMPERATURE PROFILES OBTAINED BY THE TWO-LINE ATOMIC FLUORESCENCE METHOD
G. Zizak, F. Cignoli, and S. Benecchi *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 8 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13013# Sandia Labs., Livermore, Calif.
APPLICATIONS OF OPTICAL DIAGNOSTIC TECHNIQUES IN COMBUSTION RESEARCH
D. L. Hartley and M. A. Gusinow *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 15 p refs (For primary document see N81-12993 03-99)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A13/MF A01

N81-13014# National Center for Energetics and Propulsion, Milan (Italy).
DROPLET SIZE MEASUREMENTS IN COMBUSTION BY THE VISIBILITY METHOD
A. Coghe, C. Brioschi, F. Gamma, and U. Ghezzi *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 10 p refs Prepared in cooperation with Politecnico di Milano (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-12209 Rolls-Royce Ltd., Bristol (England). Aero Div.
METALLURGICAL ASPECTS OF MATERIALS PROCESSING AND MANUFACTURING FOR AERO-ENGINE COMPONENTS
P. Wildgoose 1980 32 p
(PNR-90019) Avail: NTIS HC A03

A number of processes are discussed in terms of their metallurgical value and their effects on material properties and integrity, with particular reference to gas turbine applications. Included are precision casting, vacuum casting, blade/vane cooling, hot isostatic pressing, uni-directional solidification, titanium casting, high temperature protective coatings, inertia bonding, high strength brazing, small hole drilling, electrochemical machining, and electrodischarge machining is considered for gas turbine engine componets. Author (ESA)

N81-12210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE ROLE OF OXIDATION IN THE FRETTING WEAR PROCESS
Robert C. Bill 1980 25 p refs Proposed for presentation at the Intern. Conf. on Wear of Mater. San Francisco, 30 Mar. - 1 Apr. 1981; sponsored by AMSE and Japan Soc. of Mech. Engr. Prepared in cooperation with Army Aviation Research and Development Command, Cleveland
(NASA-TM-81570; AVRADCOM-TR-80-C-15; E-538) Avail: NTIS HC A02/MF A01 CSCL 11F

Fretting experiments were conducted on titanium, a series of Ni-Cr-Al alloys and on some high temperature turbine alloys at room temperature and at elevated temperatures in air and in various inert environments. It was found that, depending on temperature and environment, the fretting behavior of the materials examined could be classified according to four general types of behavior. Briefly, these types of behavior were: (1) the complete absence of oxidation, as in inert environments, generally leading to low rates of fretting wear but high fretting friction; (2) gradual attrition of surface oxide with each fretting stroke, found in these experiments to operate in concert with other dominating mechanisms; (3) rapid oxidation at surface fatigue damage sites, resulting in undermining and rapid disintegration of the load bearing surface; and (4) the formation of coherent, protective oxide film, resulting in low rates of fretting wear. An analytical model predicting conditions favorable to the fourth type of behavior was outlined. Author

N81-12211*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NiCrAl TERNARY ALLOY HAVING IMPROVED CYCLIC OXIDATION RESISTANCE Patent Application
C. A. Barrett, inventor (to NASA) Filed 23 Oct. 1980 6 p
(NASA-Case-LEW-13339-1; US-Patent-Appl-SN-199769) Avail: NTIS HC A02/MF A01 CSCL 11F

NiCrAl alloys were improved by the addition of zirconium. These alloys are in the beta or gamma/gamma prime + beta region of the ternary system. Zirconium was added in a very low amount between 0.06 and 0.20 weight percent. There was a narrow optimum zirconium level at the low value of 0.13 weight percent. Maximum resistance to cyclic oxidation was achieved when the zirconium addition was at the optimum value. NASA

N81-12212# Scientific Translation Service, Ann Arbor, Mich.
INFLUENCE OF ULTRASONIC VIBRATION ON SHORT-RANGE ORDER IN ALPHA-ALUMINUM BRONZES
V. Kh. Anchev (Inst. of Mechanical and Electrical Engineering, Sofiya, Bulgaria) Jul. 1980 10 p refs Transl. into ENGLISH from paper presented at the 7th Conf. on X-ray Struct. Anal. in Met. and Metallography (Poland), 1974 p 174-181 Proc. of Conf. held in Chivice, Poland, 1974 Sponsored by DOE Prepared for Argonne National Lab., Ill.
(ANL-Trans-1190; STS-Order-20282) Avail: NTIS HC A02/MF A01

The causes of softening produced by ultrasonic vibrations in single phase aluminum alloys were investigated. Several significant observations as well as the results are presented. R.C.T.

N81-12213# Battelle Columbus Labs., Ohio.
CORRELATION OF THE HIGH-TEMPERATURE CORROSION BEHAVIOR OF STRUCTURAL ALLOYS IN COAL CONVERSION ENVIRONMENTS WITH THE COMPONENTS OF THE ALLOYS AND OF THE CORROSIVE ENVIRONMENTS Final Report, May 1976 - Nov. 1979
I. G. Wright, R. O. Dodds, R. B. Palmer, H. A. Link, W. E. Merz,

and G. H. Beatty 29 Feb. 1980 141 p refs
(Contract EY-76-C-02-0092)
(BMI-2059) Avail: NTIS HC A07/MF A01

Four alloys (Inconel 671, AISI 310, Incoloy 800, and USS 18-18-2) were exposed in a series of statistically designed experiments for times up to 1000 hr in simulated coal gasifier atmospheres at total pressures of 500, 1000 and 1500 psig, and at temperatures of 1382, 1600 and 1800 F. Some data were also generated for alloys GE 1541 and Sandvik 253 MA. The progress of corrosion was evaluated by standardized metallographic techniques, with effects on mechanical properties assessed by post-test tensile tests. The data generated were statistically analyzed to determine trends. The results indicated that increasing temperature exerted a significant effect by increasing the extent of corrosion of Inconel 671, Incoloy 800 and USS 18-18-2, whereas increasing total pressure caused a significant decrease in the extent of corrosion of Incoloy 800 and AISI 310. Temperature was the most important variable affecting the tensile strength of the corroded specimens; the ultimate tensile strength of Inconel 671, AISI 310 and USS 18-18-2 increased (relative to aged specimens) with increasing temperature, suggesting that some corrosion morphologies may not be significantly detrimental. R.C.T.

N81-12214# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
PROGRESS TOWARD ANALYTICAL DESCRIPTION OF THE CREEP STRAIN-TIME BEHAVIOR ENGINEERING ALLOYS
M. K. Booker 1980 16 p refs Presented at Aspects of Creep Conf., Sheffield, England, Sep. 1980
(Contract W-7405-eng-26)
(CONF-800907-2) Avail: NTIS HC A02/MF A01

Elevated temperature design methods in the United States often require a comprehensive description of the properties of the construction materials. These descriptions include representations for creep strain-time behavior as a function of stress, temperature, and material variability. The development of analytical techniques to derive such representations is summarized. Results for several common elevated temperature structural materials are presented to illustrate the techniques. DOE

N81-12215# Giner, Inc., Waltham, Mass.
STUDY OF ALUMINUM CORROSION IN ALUMINUM SOLAR HEAT COLLECTORS USING AQUEOUS GLYCOL SOLUTION FOR HEAT TRANSFER Annual Technical Progress Report, 30 Jul. 1979 - 31 Jul. 1980
David Wong and Franklin H. Cocks Aug. 1980 42 p refs
(Contract DE-AC04-79CS-31072)
(DOE/CS-3107/T2) Avail: NTIS HC A03/MF A01

The effects of glycol aging at elevated temperatures over long periods of time were studied and the zinc powder protective technique was optimized. Glycol are known to gradually decompose into organic acids at high temperatures. These product species may be aggressive to aluminum in the long run. Corrosion inhibitors breakdown due to continuous exposure to high temperatures. As for the zinc powder protective technique, efforts were made to determine the optimal conditions under which aluminum solar collector panels can be protected most effectively and economically. Both uninhibited and inhibited ethylene as well as propyleneglycols were aged at three different temperatures (100, 140, and 190 C) for 6000 hours continuously. Aliquot samples were taken at 1000 hour intervals for pH measurement and chemical analysis. Results showed that in most cases solution pH dropped sharply during the first 1000 hours of exposure and gradually decreased at a slower pace as the aging process progressed. DOE

N81-12216# Argonne National Lab., Ill. Materials Science Div.
CORROSION AND MECHANICAL BEHAVIOR OF MATERIALS FOR COAL GASIFICATION APPLICATIONS
K. Natesan May 1980 98 p refs
(Contract W-31-109-eng-38)
(ANL-80-5) Avail: NTIS HC A05/MF A01

A state-of-the-art review is presented on the corrosion and mechanical behavior of materials at elevated temperatures in coal-gasification environments. The gas atmospheres in coal-conversion processes are, in general, complex mixtures which contain sulfur-bearing components (H2S, SO2, and COS) as well as oxidants (CO2/CO and H2O/H2). Information developed clearly shows sulfidation to be the major mode of material degradation in these environments. The corrosion behavior of structural materials in complex gas environments is examined to evaluate the interrelationships between gas chemistry, alloy chemistry, temperature, and pressure. Thermodynamic aspects of high-temperature corrosion processes that pertain to coal conversion are discussed, and kinetic data are used to compare the behavior of different commercial materials of interest. Areas of additional research with particular emphasis on the development of a better understanding of corrosion processes in complex environments and on alloy design for improved corrosion resistance are discussed. Author

N81-12217# Bendix Corp., Kansas City, Mo.
THIN FILM CORROSION Final Report
M. K. Raut Jun. 1980 26 p ref
(Contract DE-AC04-76DP-00613)
(BDX-613-2435) Avail: NTIS HC A03/MF A01

Chromium/gold (Cr/Au) thin films were exposed to vapors of various solutions (etchants, strippers, developers, etc.) used during photolithography prebond etching and cleaning. Gold, chromium, and tantalum etchants were found to be the main corrosives. Stabilized Cr/Au films had higher corrosion rates than the unstabilized ones. To minimize any corrosion from prebond ceric ammonium nitrate (CAN) etching, shortened CAN etch time (10 seconds) and prerinse of 10 percent nitric acid was compared to the current 1 minute of CAN etching. The 10 second CAN etch was effective in removing chromium oxide as well as in minimizing the cerium residue at the gold surface. Potentiodynamics (current versus potential) scans were recorded for gold, palladium, and chromium in 1,000 ppm gold etch solution, and their corrosion rates were calculated. The measurements indicated that placing palladium between the gold/chromium layers will decrease corrosion in thin film networks caused by gold etchant. Author

N81-12218# Ames Lab., Iowa.
ELECTROTRANSPORT OF SOLUTES IN REFRACTORY METALS Final Report, 1 Oct. 1978 - 14 Dec. 1979
F. A. Schmidt, O. N. Carlson, M. S. Beck, D. K. Rehbein, and D. E. Williams 1979 31 p refs
(Contract W-7405-eng-82)
(IS-4722) Avail: NTIS HC A03/MF A01

The electric mobilities, diffusivities and effective valences were determined for molybdenum, rhenium, tungsten and zirconium in beta-thorium. All four solutes migrated in the same direction as the electron flow. Rhenium and molybdenum were found to be very mobile with tungsten somewhat slower. Zirconium was found to move at a rate near that of the self-diffusion of beta-thorium, viz., approximately two orders of magnitude slower than rhenium and tungsten. The electromigration velocities showed a similar trend. Comparison was made between experimental data obtained by laser ion mass spectrometry and theoretical transport equations for two purification experiments. DOE

N81-12219# Bendix Corp., Kansas City, Mo.
THE IMPROVEMENT OF EXTERNAL LEAD BOND AND FLEXURE STRENGTHS BY COMPARING LEAD BASE MATERIALS
R. J. Blazek and W. A. Piper Apr. 1980 8 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2339; CONF-800410) Avail: NTIS HC A02/MF A01

Four types of copper alloys were studied to determine which base material properties produced the most improved bond and flexure strengths when compared to the standard production lead frame. The standard lead frame consisted of a CDA194 copper alloy which was vacuum annealed and plated with gold and nickel. Bond testing concluded that an annealed or unannealed CDA102 or CDA110 copper alloy plated with gold and nickel produced the most consistently acceptable bond and flexure strengths. It is further shown that the recommended lead frame is an annealed CDA102 copper alloy plated with gold and nickel. R.C.T.

N81-12220# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.

EFFECT OF VARIOUS SURFACE PROTECTIONS ON THE STRESS CORROSION BEHAVIOR OF LIGHT ALLOYS [INFLUENCE DE DIFFERENTES PROTECTIONS SUR LA TENUE A LA CORROSION SOUS TENSION DES ALLIAGES LEGERS]

C. Bezaud Paris 10 Jun. 1980 34 p In FRENCH Presented at Congr. Intern. SURFAIR, Cannes, France, 27-29 May 1980 (SNIAS-801-551-102) Avail: NTIS HC A03/MF A01

Samples of three aluminum alloys (A-7U4SG, A-U4G1, A-U2GN) were subjected to constant load flexural strength tests under aircraft riveting and bolting conditions to determine the effectiveness of surface treatment techniques in corrosion prevention. Vapor blast treatment did not lead to any improvement. Shot treatment did, however, lead to a slight improvement. Chromic and sulphuric anodization did not produce any significant amelioration. Electrolytic deposits of cadmium and zinc gave good results. Paints applied after sulpho-chromic cleaning also produced good results when there were no scratches. Author (ESA)

N81-12221# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.

USE OF SUPERPLASTIC FORMING TECHNIQUES TO FABRICATE TITANIUM ALLOY (T-A6V) TANKS [UTILISATION DE LA TECHNIQUE DE FORMAGE SUPERPLASTIQUE POUR LA FABRICATION DE RESERVOIRS EN ALLIAGE DE TITANE T-A6V]

Budillon, J. Chanteranne, and Huellec Paris 10 Jun. 1980 12 p refs In FRENCH Presented at 4th Intern. Conf. on Titanium, Kyoto, May 1980

(SNIAS-801-551-103) Avail: NTIS HC A02/MF A01

The development of toroidal and spherical tanks for nitrogen storage for aerospace applications was studied. Theoretical and practical results on the superplastic properties of this alloy are presented. Welding characteristics are discussed. The industrial realization of semi-tori with small radii of curvature and hemispheres with different relative thicknesses (thickness/diameter ratios) is described. The hot working technique presents advantages over more classical methods. Less waste metal is produced and machining time is shorter. Author (ESA)

N81-12222# European Space Agency, Paris (France).

INFLUENCE OF THERMOMECHANICAL TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIGH-STRENGTH ALUMINUM ALLOYS

Karl Welpmann, Gead Luetjering, and Wolfgang Bunk Jun. 1980 105 p refs Transl. into ENGLISH of 'Einfluss von thermomechanischer behandlung auf Mikrostruktur u. mech. Eigenschaften von hochfesten Aluminium-Legierungen', DFVLR, Cologne Rept. DLR-FB-77-50, 19 Sep. 1977 Original German report available from DFVLR, Cologne DM 40,70

(ESA-TT-507; DLR-FB-77-50) Avail: NTIS HC A06/MF A01

The influence of a thermomechanical treatment (TMT) on the microstructure and the mechanical properties of AlZnMgCu alloys was investigated. The inhomogeneous slip which occurs during the rolling process produced shear-offsets at the grain boundaries and so reduced the effective grain boundary length. In a pure alloy without Fe, Si, and Cr this microstructural modification caused an improvement of various mechanical properties: the tensile ductility increased, as well as lifetime in fatigue tests; the stress corrosion cracking resistance of the alloy was enhanced, and the fracture toughness values were raised; and the fatigue crack propagation behavior in the high crack propagation rate regime was improved. At low crack propagation rates the cracks propagated along slip bands; in this regime the TMT caused a deterioration of the crack propagation behavior. Commercial AlZnMgCu alloys also showed microstructural modifications at the grain boundaries produced by the TMT. These alloys were found to be only slightly affected by the TMT. Author (ESA)

N81-12223# Aeronautical Research Inst. of Sweden, Stockholm. *Structures Dept.*

STATIC AND FATIGUE TESTING OF PRECISION CAST STEEL AND ALUMINUM

Nils Larsson Jul. 1980 52 p

(Contract FMV-F-FL-82223-78-003-21-001)

(FFA-TN-HU-2106) Avail: NTIS HC A04/MF A01

The specimen geometry and the testing procedure are detailed. The static tests show that for steel material the mean rupture stresses from different castings are very much the same, whereas the yield stresses vary considerably. The results from aluminum fatigue tests do not reveal any relation between life and thickness of specimen or casting. Author (ESA)

N81-12983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THIN-FILM COATINGS

Donald H. Buckley *In its* Impact of the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 65-74 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 11F

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-12224# AiResearch Mfg. Co., Torrance, Calif.

EVALUATION OF FILAMENT-WOUND KEVLAR-49/EPOXY FATIGUE PROPERTIES Final Report

3 Jun. 1980 31 p refs Sponsored by DOE

(UCRL-15264; FR-80-17120) Avail: NTIS HC A03/MF A01

The long-term properties of Kevlar-49/epoxy composite in a fatigue and elevated temperature environment are determined for use in the design of composite flywheel energy storage units. Testing shows that Kevlar-49 has the property of increasing tensile modulus of elasticity under fatigue loading conditions. The change in modulus is shown to be a function of temperature, induced stress level, and number of fatigue cycles. The average modulus before cycling was 13.28 million psi at ambient temperature versus 11.96 million psi at 150 F. Creep or residual strain after 1000,000 cycles was .00041 in/in (ambient) and .00117 in/in (150F) at 140 ksi maximum stress level. At 190 ksi temperature did not show any effects on creep, which was measured to be approximately .0028 in/in. The ultimate strength of 150 F rings was 249,000 psi compared to 262,000 psi for ambient temperature. All 140 ksi stress level rings went to 1000,000 cycles without failure, whereas four of the six 190 ksi rings fatigue failed. Residual strength tests for those rings which did not fatigue fail show a lower strength than non-cycled rings. M.G.

N81-12225*# Boeing Commercial Airplane Co., Seattle, Wash. Preliminary Design Dept.

AIRCRAFT SURFACE COATINGS STUDY: ENERGY EFFICIENT TRANSPORT PROGRAM Final Report

Jan. 1979 115 p refs

(Contract NAS1-14742)

(NASA-CR-158954; D6-46699) Avail: NTIS HC A06/MF A01 CSCL 11C

Surface coating materials for application on transport type aircraft to reduce drag, were investigated. The investigation included two basic types of materials: spray on coatings and adhesively bonded films. A cost/benefits analysis was performed, and recommendations were made for future work toward the application of this technology. Author

N81-12226*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF LOAD, AREA OF CONTACT, AND CONTACT STRESS ON THE WEAR MECHANISMS OF A BONDED SOLID LUBRICANT FILM

Robert L. Fusaro 1980 22 p refs Prepared for the 3d Intern. Conf. on Wear of Mater., San Francisco, 30 Mar. - 1 Apr. 1981; sponsored by the Am. Soc. of Mech. Eng.

(NASA-TM-81563; E-525) Avail: NTIS HC A02/MF A01 CSCL 11H

A pin on disk type of friction and wear apparatus was used to study the effect of load, contact stress and rider area of contact on the friction and wear properties of polyimide bonded graphite fluoride films. Different rider area contacts were obtained

by initially generating flats (with areas of 0.0035, 0.0071, 0.0145, and 0.0240 cm) on 0.476-cm radius hemispherically tipped riders. Different projected contact stresses were obtained by applying loads of 2.5- to 58.8-N to the flats. Two film wear mechanisms were observed. The first was found to be a linear function of contact stress and was independent of rider area of contact. The second was found to increase exponentially as the stress increased. The second also appeared to be a function of rider contact area. Wear equations for each mechanism were empirically derived from the experimental data. In general, friction coefficients increased with increasing rider contact area and with sliding duration. This was related to the build up of thick rider transfer films. Author

N81-12227*# Monsanto Research Corp., St. Louis, Mo.
FORMULATION AND EVALUATION OF C-ETHER FLUIDS AS LUBRICANTS USEFUL TO 260 C Final Contractor Report
F. S. Clark and D. R. Miller Dec. 1980 155 p refs
(Contract NAS3-19746)
(NASA-CR-159794; MRC-SL-1007) Avail: NTIS HC A08/MF A01 CSCL 11H

Three base stocks were evaluated in bench and bearing tests to determine their suitability for use at bulk oil temperatures (BOT) from -40 C to +260 C. A polyol ester gave good bearing tests at a bulk temperature of 218 C, but only a partially successful run at 274 C. These results bracket the fluid's maximum operating temperature between these values. An extensive screening program selected lubrication additives for a C-ether (modified polyphenyl ether) base stock. One formulation lubricated a bearing for 111 hours at 274 C (BOT), but this fluid gave many deposit related problems. Other C-ether blends produced cage wear or fatigue failures. Studies of a third fluid, a C-ether/disiloxane blend, consisted of bench oxidation and lubrication tests. These showed that some additives react differently in the blend than in pure C-ethers. Author

N81-12228# Washington Univ., Seattle. Dept. of Chemistry.
A REINVESTIGATION OF TRANSIENTS IN THE CYCLOPROPANE SYSTEM BY THE VARIABLE ENCOUNTER METHOD
M. C. Flowers, F. C. Wolters, D. F. Kelley, and B. S. Rabinovitch 15 Sep. 1980 25 p refs
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A090168; TR-017) Avail: NTIS HC A02/MF A01 CSCL 07/3

A reinvestigation of transients in cyclopropane vibrational relaxation by the Variable Encounter Method (VEM) has been made. Temperatures in the region 800 K to 1125 K were used. Concurrent study of cyclobutane was made. Results of earlier work in this series by Kelley, et al., are confirmed. The contribution to reaction R(n) as a function of number of collisions (n) is displayed, as well as the distribution of collisions f(n) in each reactor. A general comparison of all data in the literature is made. GRA

N81-12229# Massachusetts Univ., Amherst. Dept. of Polymer Science and Engineering.
STUDIES OF POLYURETHANES AND EPOXY CURING REACTIONS Final Report, 15 Oct. 1978 - 15 Oct. 1979
William J. MacKnight Aug. 1980 41 p refs
(Contract DAAG46-79-C-0004; DA Proj. 1L1-61102-AH-42)
(AD-A089947; AMMRC-TR-80-43) Avail: NTIS HC A03/MF A01 CSCL 11/9

The research performed by the Polymer Science and Engineering Department at the University of Massachusetts, (Amherst) during the period 10/15/78 to 10/15/79 is summarized in this report. The work was supported by U.S. Army Contract DAAG-46-79-C-0004 from the Army Materials and Mechanics Research Center, Watertown, MA, with Dr. Nathan Schneider serving as the contracting officers representative. GRA

N81-12230# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemical Engineering.
PROPERTIES OF SOME DIBLOCK COPOLYMERS BASED ON 1,3 BUTADIENE MONOMER
Robert E. Cohen, Jose M. Torradas, and David E. Wilfong 25 Aug. 1980 16 p refs
(Contract N00014-77-C-0311; NR Proj. 356-646)
(AD-A090144; TR-6) Avail: NTIS HC A02/MF A01 CSCL 11/10

The properties of three series of diblock copolymers are discussed. One series of polymers is comprised of two diblock copolymers of polystyrene and 1,2 polybutadiene in which the polybutadiene microstructure is essentially pure 1,2 addition. Hydrogenation of these polymers leads to a second set of block copolymers of polystyrene and polybutene-1. The polybutene-1 segments are atactic and therefore exhibit amorphous, rubbery behavior. A third series of samples contains four diblock copolymers of 1,4 polybutadiene and 1,2 polybutadiene; microphase separation is observed for these 1,4 polybutadiene/1,2 polybutadiene materials. Results of small-amplitude forced-oscillation mechanical tests and of large deformation constant rate of strain measurements are reported and discussed. GRA

N81-12231# National Bureau of Standards, Washington, D.C. Fracture and Deformation Div.
HOT ERROSION OF GLASS Interim Report
S. M. Wiederhorn and B. J. Hockey Jun. 1980 15 p refs
(AD-A090312; NBSIR-80-2034) Avail: NTIS HC A02/MF A01 CSCL 11/2

In this paper the effect of plastic flow on the erosion of soda-lime-silicate glass at elevated temperatures is investigated. Although the erosion of glass at 500 C and 600 C is still basically a brittle process, viscous relaxation of glass during impact reduces the driving force for fracture and thus the size of the chips that are formed during erosion. As a result, the erosion rate of glass at 500 C or 600 C is decreased by a factor of 2 compared to that measured at room temperature. To completely eliminate fracture during erosion, a temperature of approximately 800 C is estimated for soda-lime-silicate glass. GRA

N81-12232# National Bureau of Standards, Washington, D.C. Center for Materials Science.
MICROMECHANISMS OF CRACK GROWTH IN CERAMICS AND GLASSES IN CORROSIVE ENVIRONMENTS Interim Report
S. M. Wiederhorn, E. R. Fuller, Jr., and R. M. Thomson May 1980 44 p refs Sponsored in part by ONR
(AD-A090735; NBSIR-80-2023) Avail: NTIS HC A03/MF A01 CSCL 11/2

At normal temperatures and pressures, water is known to have a strong influence on the strength of ceramics and glasses. Behaving as a stress-corrosion agent, water causes these materials to fail prematurely as a consequence of subcritical crack growth. A basic premise of this paper is that stress-corrosion cracking of ceramics is a chemical process that involves a stress-enhanced chemical reaction between the water and the highly stressed ceramic near the crack tip. Plastic deformation is believed to play no role in this fracture process. After a brief survey of chemical reaction rate theory, the basic rate equation from this theory is modified to reflect physical and chemical processes that occur at crack tips. Modification of the rate equation is based on the assumption that the crack tip can be modelled as an elastic continuum, an assumption that is supported by a simple atomistic model of crack growth. When tested against experimental data collected on glass, the theory was found to be consistent with measurements of the crack-growth dependence on temperature, applied stress intensity factor, and concentration of reactive species in the environment. GRA

N81-12233# Massachusetts Univ., Amherst. Dept. of Mechanical Engineering.
LUBRICATION BY SOLID COATING IN HYDROSTATIC EXTRUSION Final Report, 1 Feb. 1977 - 31 Aug. 1980
William R. D. Wilson Sep. 1980 8 p refs
(Grant DAAG29-77-G-0091)
(AD-A090583; ARO-14515.5-E) Avail: NTIS HC A02/MF A01 CSCL 11/8

Research on the thickness of lubricant coatings entrained during hydrostatic extrusion and the transport of solid lubricants is described. GRA

N81-12234# Honeywell Corporate Material Sciences Center, Bloomington, Minn.

CRACK PROPAGATION AND DEFORMATION IN PZT TRANSDUCER CERAMICS Final Report, 1 Mar. 1976 - 29 Feb. 1980
K. D. McHenry and B. G. Koepke 1 May 1980 20 p refs
(Contract N00014-76-C-0625)
(AD-A090569; Rept-47700) Avail: NTIS HC A02/MF A01 CSCL 11/2

This report summarizes studies completed over the period 3/1/76 to 2/29/80 representing a research program on environmental, chemical, electrical and mechanical effects on crack propagation in the piezoelectric transducer ceramic PZT. Stress relaxation and the photomechanical effect in PZT are also discussed. GRA

N81-12235# PRB-Recticel, Wetteren (Belgium).
DEVELOPMENT OF A NEW POLYUREA FOAM INSULATION MATERIAL Final Report, 1 Jan. 1978 - 30 Jun. 1979
H. Creyf 1980 49 p refs
(EUR-6737-EN) Avail: NTIS (US Sales Only) HC A03/MF A01; DOE Depository Libraries

A low density, self extinguishing insulation material was developed. The research was carried out on a lab scale, a semi-industrial and an industrial scale. The laboratory research yielded a formulation which could be used on a semi-industrial scale. The physical parameters of the panels were measured and found to meet the requirements set. An economic evaluation of the application of polyurea foam in a bungalow type house shows to be quite positive. DOE

N81-12236# Siemens A.G., Erlangen (West Germany). Forschungslaboratorium.
SPACE-CHARGES IN POLYMERS Final Report
Bernhard Andress, Peter Fischer, Kurt Nissen, and Peter Roehl Aug. 1980 129 p refs In GERMAN
(BMFT-FB-T-80-036) Avail: NTIS (US Sales Only) HC A07/MF A01; DOE Depository Libraries

A nondestructive method for the determination of space-charges in polyethylene was developed. Electrons were injected into the polyethylene. No difference in the space charge build up was observed when different contracting metals or semiconducting polymer electrodes was used. During ac-stressing space charges built up very gradually in the polymer, but an influence upon the breakdown strength was not registered even after prestressing for long times at high average field strengths. It seems more probable that physical/chemical changes account for the observed decrease in breakdown strength with time. Further breakdown measurements indicate that breakdown in polyethylene is initiated in the crystalline regions by electronic processes. It was possible to correlate the improved breakdown strength of oxidized polyethylenes with the electrical conduction behavior in these materials. DOE

N81-12237# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
POLYKETONES AND POLYSULFONES FOR CONSERVATION IN THE ETHYLENE POLYMER Progress Report
Meyer Steinberg, Richard Johnson, David Elling, William Cordes (Tenneco Chemicals, Inc., Piscataway, N.J.), and Donald Goodman (Tenneco Chemicals, Inc., Piscataway, N.J.) Jan. 1980 35 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51155; ECI-TID-4500; UC-95F; PR-6) Avail: NTIS HC A03/MF A01

Copolymers were prepared at various levels of CO composition, and with several methods of catalysis, including free-radical, metallic, and CO-60 irradiation. Et-CO copolymers exhibit crystallinity related to the alternating polyketone structure which increases logarithmically with CO content over the range 28% to 49% CO. The melting point increases in essentially the same manner as crystallinity. The structure of the copolymers is independent of the type of catalysis used. Highly crystalline copolymers showed discoloration and loss of crystallinity at 140 C, whether in air or N2. Discoloration is severe at 210 C, and after heating at 280 C for 1 hr, essentially all crystallinity was lost. Thermal degradation, as characterized by loss of crystallinity, evolution of water, and formation of olefinic unsaturation, was described in the literature as crotonic self-condensation. Press molding of highly crystalline copolymer at 260 C for 5 minutes showed 38.8% loss of crystallinity and appearance of H20 and olefinic unsaturation. Author

N81-12238# General Electric Co., St. Petersburg, Fla. Metallurgy and Ceramics Lab.
AXIAL COMPRESSION TESTING OF VACUUM TUBE GLASS CERAMIC/MOLYBDENUM FRAMES
R. K. Spears 17 Sep. 1980 34 p ref
(Contract DE-AC04-76DP-00656)
(GEPP-TIS-503) Avail: NTIS HC A03/MF A01

The strength of a vacuum tube subassembly is affected by many factors, including the subassembly design, the process used to bond the parts, and the type of equipment used to measure the strength. These variables were examined for a subassembly consisting of a molybdenum sleeve, a glass ceramic insulator, and a molybdenum cylindrical frame. Compression testing of different designs ranged from 765 to 3170 pounds. No difference appeared in the strength of subassemblies due to variations in selected steps in processing. A self aligning compression test fixture resulted in higher strength readings than those obtained with conventional fixturing. DOE

N81-12239# General Electric Co., St. Petersburg, Fla. Metallurgy and Ceramics Lab.
MICROSTRUCTURE EXAMINATION OF THE INTERFACE OF THE GLASS-CERAMIC INSULATOR OF THE MOLYBDENUM FRAME OF A VACUUM TUBE
R. K. Spears 17 Sep. 1980 12 p refs
(Contract DE-AC04-76DP-00656)
(GEPP-TIS-516) Avail: NTIS HC A02/MF A01

A common technique used in examining the structural integrity of a glass ceramic insulator molybdenum cylinder bond in a vacuum tube subassembly is to slit the outer molybdenum cylinder and separate it from the glass ceramic insulator. Typically, a black glassy layer (0.001 to 0.002 in. thick) remains on the cylinder. This layer has been interpreted as a requirement for an adequate seal. Investigation of approximately 100 subassemblies revealed four parts lacking a black glassy layer. A microstructural analysis showed that on those parts having a black glassy layer, the crystalline phase in the glass ceramic grew to within one to two microns of the metal interface and then terminated. A dark region existed in the insulator between the interface and the termination of the crystalline phase. This was attributed to molybdenum oxide dissolved in the glass. DOE

N81-12240# Bendix Corp., Kansas City, Mo.
BONDING SILICONS WITH EPOXIES
James S. Tira 1980 13 p Presented at the DOE Weapons Complex Ann. Adhesives Conf., St. Petersburg, Fla., 29-30 Apr. 1980
(Contract DE-AC04-76DP-00613)
(BDX-613-2432) Avail: NTIS HC A02/MF A01

The surface preparation and bonding of silicon materials with epoxies is discussed. It is shown that silicons, both room temperature vulcanizing and millable rubber (press cured) can be successfully bonded to other materials using plasma treatment and epoxy adhesives. The plasma treatment using dry air atmosphere increases the surface energy of the silicone and thus provides a lower water angle. This phenomenon allows the epoxy adhesive to wet the silicone surface and ultimately bond. Bond strengths are sufficiently high to result in failures in the silicone materials rather than the adhesive bond. M.G.

N81-12241# Bendix Corp., Kansas City, Mo.
EVALUATION OF IMPROVED POLYAMIDES
R. J. Hishaw Jun. 1980 18 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2354) Avail: NTIS HC A02/MF A01

Three polyamides, nylon 11, nylon 12, and a transparent nylon, were evaluated by physical testing, characterization and analytical methods, and injection molding. None of the materials proved to be clearly superior to the others. Results of the evaluation are to be used to determine applications for the materials in future production programs. R.C.T.

N81-12242# Sandia Labs., Albuquerque, N. Mex.
MORPHOLOGY AND PHASE COMPOSITION OF AN AMINE CURED RUBBER MODIFIED EPOXY

J. A. Sayre, R. A. Assink, and R. R. Lagasse 1980 31 p refs Presented at Intern. Conf. on Polymer Compatibility and Incompatibility, Principles and Practices, Midland, Mich., 18 Aug. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1914C; CONF-800844-1) Avail: NTIS HC A03/MF A01

The sharpness of the interface between the matrix and the dispersed phase, the volume fraction of the dispersed phase, the distribution of particle sizes, and the concentration of epoxy in the dispersed phase were determined. Scanning transmission electron microscopy coupled with energy dispersive X-ray analysis revealed that the interface width is less than 500 A. Variation of the fraction of mobile hydrogens with temperature determined by nuclear magnetic resonance indicated that a small fraction of segements participated in mixing at the interface. Differential scanning calorimetry and nuclear magnetic resonance indicated that all the rubber precipitates as a discrete phase. The distribution of particles greater than 0.1 micrometer in diameter was measured, and the average diameter of these particles was found to be 0.8 micrometer. The particles larger than 0.1 micrometer accounted for approximately 50% of the total volume of dispersed phase. DOE

N81-12243# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT AND TESTING OF POLYMER REFLECTORS
R. A. Assink 1980 9 p refs Presented at Line-Focus Solar Thermal Energy Technol. Development Conf., Albuquerque, N. Mex., 9 Sep. 1980
(Contract DE-AC04-76DA-00789)
(SAND-80-1483C; CONF-800955-1) Avail: NTIS HC A02/MF A01

Metallized polymer sheets and films offer the potential of providing a low cost, light weight and easily installed solar reflector surface. Metallized polymers presently available, however, suffer from three disadvantages: (1) low initial reflectance; (2) uv degradation; and (3) surface abrasion. The solar reflectance properties of commercially available aluminized polymers are typically 0.06 to 0.10 reflectance units (1.00 reflectance units = 100 percent reflectance) lower than the solar reflectance properties of high quality silvered glasses. This difference results from the inherently lower solar reflectance of aluminum as compared to the solar reflectance of silver. Efforts to deposit and protect silver on a polymer surface have not been successful. Recent studies, however, indicate that uv degradation may not be a serious problem for acrylic materials. Abrasion of the polymer surface by wind blown sand or contact cleaning methods can cause a substantial reduction in the specularity of the reflector. DOE

N81-12244# Bendix Corp., Kansas City, Mo.
PHENOLIC RESIN SYNTACTIC FOAMS
H. M. McIlroy Jun. 1980 19 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2408) Avail: NTIS HC A02/MF A01

Syntactic foams were prepared from blends of six phenolic resins and carbon microbubbles. The compressive of strength of the phenolic resin foams is equivalent to the strength of foams made from a polyimide resin. Ammonia evolved during the cure diffuses rapidly and is not bound by the foam. R.C.T.

N81-12245# Bendix Corp., Kansas City, Mo.
MOISTURE PENETRATION EVALUATION OF POLYSTYRENE BEAD FOAM AS AN ENCAPSULANT FOR ELECTRONIC PACKAGES
G. D. Swanson Jun. 1980 15 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2394) Avail: NTIS HC A02/MF A01

Discs of polystyrene bead foam were used to measure resistance to high pressure moisture penetration. Densities of 0.2, 0.3, 0.4, 0.5, and 0.6 g/cu cm processed at various fusion times and temperatures were tested. Only three fusion conditions for 0.6 g/cu cm density were impervious to moisture penetration at 1724 kPa for 24 hours or more. R.C.T.

N81-12246# Bendix Corp., Kansas City, Mo.
TEST METHODS FOR THE DYNAMIC MECHANICAL PROPERTIES OF POLYMERIC MATERIALS Final Report
G. K. Baker Jun. 1980 70 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2405) Avail: NTIS HC A04/MF A01

Various test geometries and procedures for the dynamic mechanical analysis of polymers employing a mechanical spectrometer were evaluated. The methods and materials included were forced torsional pendulum testing of Kevlar/epoxy laminates and rigid urethane foams, oscillatory parallel plate testing to determine the kinetics of the cure of VCE with Hylene MP, oscillatory compressive testing of B-3223 cellular silicone, and oscillatory tensile testing of Silastic E and single Kevlar filaments. Fundaments dynamic mechanical properties, including the storage and loss moduli and loss tangent of the materials tested, were determined as a function of temperature and sometimes of frequency. R.C.T.

N81-12247# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Ballistiques et Spatiaux.
USE OF ULTRA-LIGHT ADHESIVE FOR METAL HONEYCOMB BONDING
J. Chanteranne Paris 1979 5 p Presented at SAMPE, San Francisco, 10 Jun. 1979
(SNIAS-801-422-104) Avail: NTIS HC A02/MF A01

The design of satellite panels in sandwich structures must be optimized, in order to reduce the mass by fitting the strength of the bonding menisci to the strength of the honeycomb core. This optimization applied to the satellite structures of the Intelsat 5 family led to the use of an adhesive of very low surface mass (100 g/sq m). Production techniques with adhesive films, using the primer Redux 312 UL are described. Changes in adhesive menisci geometry and strength, related to the hygrometry of the bonding room and the use of the primer, are shown. Author (ESA)

N81-12248# Royal Aircraft Establishment, Farnborough (England).
EVALUATION OF WOVEN FABRICS BASED ON GRAPHIL XAS 3000-FILAMENT CARBON FIBRE
L. N. Phillips and D. J. Murphy London HMSO Mar. 1980 14 p refs
(RAE-TM-Mat-339; BR74612) Avail: NTIS HC A02/MF A01

All carbon and carbon/glass hybrid fabrics were woven from 3000 filament, Courtaulds XAS fiber, and the fabric properties were measured. Laminates were made from each fabric, using the Ciba-Geigy epoxide XD927 as the common matrix throughout. There were no problems with wetting or cure. Mechanical tests showed the all carbon five shaft satin to be somewhat stronger than the twill, while in the hybrid fabrics, the twill was stronger than the plain weave. Neither with the all carbon fabrics nor with the carbon/glass hybrids was there a marked effect of the weave on modulus. The level of mechanical properties showed woven XAS to be an extremely useful reinforcement, with good translation of fiber properties into laminates. Author (ESA)

N81-12249# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Technological Centre.
MECHANICAL PROPERTIES OF KEVLAR REINFORCED REDUX 312 L ADHESIVE JOINTS
R. Exalto and J. Koning Mar. 1979 36 p refs
(FOK-R-2369) Avail: NTIS HC A03/MF A01

The mechanical properties of adhesive joints reinforced with Kevlar 49 were studied. The bonding system Redux 312 L reinforced with Kevlar weave 0.1 mm thick shows optimal lap shear test results. However, low peel strength results are found. Using thicker adhesive films in this bonding system and a Kevlar film thickness of 0.2 mm, may result in optimal lap shear test results as well as optimal peel test results. Author (ESA)

N81-12250# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Technological Centre.
ACOUSTIC EMISSION OF CARBON FIBER REINFORCED PLASTICS
M. Eikelboom 29 Aug. 1979 72 p refs
(FOK-R-2464) Avail: NTIS HC A04/MF A01

An acoustic emission study was carried out on carbon fiber reinforced plastic specimens to characterize and distinguish between different failure processes in the material. The ampli-

tude distribution method was used. Three distinct peaks were found with amplitudes of 31 db, 43 db and 51 db which were correlated with matrix cracking, fiber matrix delamination and fiber cracking respectively. Author (ESA)

N81-12251# European Space Research and Technology Center, Noordwijk (Netherlands).
EVALUATION OF A CONDUCTIVE ADHESIVE SYSTEM FOR THE GROUNDING OF ALUMINIZED KAPTON COATED WITH INDIUM/TIN OXIDE
J. Bosma and M. Froggatt Paris ESA Aug. 1980 63 p ref (ESA-STM-213; ISSN-0379-4075) Avail: NTIS HC A04/MF A01

The results of a prequalification program of a thermal control coating developed to provide spacecraft charge control are described. An indium/tin oxide (ITO) coated aluminized Kapton layer was used with aluminum ground straps bonded to the ITO layer with a conductive adhesive. Prequalification is granted for use on application satellites, while for scientific satellites there are some reservations. Author (ESA)

N81-12252# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
COMPILATION OF TEST DATA FROM AN INVESTIGATION ON THE INFLUENCE OF ENVIRONMENTAL AGING AND DISPLACEMENT RATE ON CRACK RESISTANCE OF ADHESIVES
J. Lameris 1 Mar. 1979 80 p ref
(Contract NIVR-1722)
(NLR-TR-79020-U) Avail: NTIS HC A05/MF A01

Results of crack resistance tests of a total of 204 specimens are given with an average of 10 determinations of crack length and crack resistance for three adhesives and two surface treatments. Adhesives EC2216, Redux 775, and Metlbond were tested with chromic acid and phosphoric acid anodized surface treatments. Author (ESA)

N81-12253# National Technical Information Service, Springfield, Va.
HEAT RESISTANT PLASTICS: SILICONE, CARBORANE, HALOCARBON, AND OTHER POLYMERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Aug. 1980
Diane M. Cavagnaro Aug. 1980 254 p Supersedes NTIS/PS-79/0950; NTIS/PS-78/0770
(PB80-814734; NTIS/PS-79/0950; NTIS/PS-78/0770) Avail: NTIS HC $30.00/MF $30.00 CSCL 11I

The bibliography excludes nitrogen containing polymers but presents research on other heat resistant plastics and elastomers. The citations mainly pertain to the following resins: polysilicones, polycarboranes, phosphorus containing polymers, and halocarbon polymers. The chemical properties, synthesis, physical and mechanical properties, applications and fabrication of these polymers are covered. This updated bibliography contains 249 citations, 34 of which are new entries to the previous edition. GRA

N81-12254# National Technical Information Service, Springfield, Va.
HEAT RESISTANT PLASTICS: NITROGEN CONTAINING POLYMERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Aug. 1980
Diane M. Cavagnaro Aug. 1980 234 p Supersedes NTIS/PS-79/0949; NTIS/PS-78/0769
(PB80-814742; NTIS/PS-79/0949; NTIS/PS-78/0769) Avail: NTIS HC $30.00/MF $30.00 CSCL 11I

The citations cover the synthesis, application, testing, decomposition, and properties of heat resistant nitrogen containing polymers. Two major polymers discussed are polyquinoxalines and polybenzimidazoles. This updated bibliography contains 229 citations, 28 of which are new entries to the previous editions. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-12255*# United Technologies Corp., East Hartford, Conn.
EXPERIMENTAL STUDY OF THE STABILITY OF AIRCRAFT FUELS AT ELEVATED TEMPERATURES
Alexander Vranos and Pierre J. Marteney Dec. 1980 31 p refs
(Contract NAS3-21593)
(NASA-CR-165165; R80-954440-17) Avail: NTIS HC A03/MF A01 CSCL 21D

An experimental study of fuel stability was conducted in an apparatus which simulated an aircraft gas turbine fuel system. Two fuels were tested: Jet A and Number 2 Home Heating oil. Jet A is an aircraft gas turbine fuel currently in wide use. No. 2HH was selected to represent the properties of future turbine fuels, particularly experimental Reference Broad Specification, which, under NASA sponsorship, was considered as a possible next-generation fuel. Tests were conducted with varying fuel flow rates, delivery pressures and fuel pretreatments (including preheating and deoxygenation). Simulator wall temperatures were varied between 422K and 672K at fuel flows of 0.022 to 0.22 Kg/sec. Coking rate was determined at four equally-spaced locations along the length of the simulator. Fuel samples were collected for infrared analysis. The dependence of coking rate in Jet A may be correlated with surface temperature via an activation energy of 9 to 10 kcal/mole, although the results indicate that both bulk fluid and surface temperature affect the rate of decomposition. As a consequence, flow rate, which controls bulk temperature, must also be considered. Taken together, these results suggest that the decomposition reactions are initiated on the surface and continue in the bulk fluid. The coking rate data for No. 2 HH oil are very highly temperature dependent above approximately 533K. This suggests that bulk phase reactions can become controlling in the formation of coke. Author

N81-12256# Army Missile Command, Redstone Arsenal, Ala. Propulsion Directorate.
LOW TEMPERATURE X-RAY DIFFRACTION INVESTIGATION OF EMBRITTLED MINIMUM SIGNATURE CHAPARRAL PROPELLANT
Bernard J. Alley Jun. 1980 14 p refs
(AD-A090356) Avail: NTIS HC A02/MF A01 CSCL 21/9

The Army has been developing a minimum signature propellant motor for an improved CHAPARRAL air defense weapon system since 1975. As part of validation and qualification, the motor was subjected to a diurnal temperature cycling tests during FY78 to simulate field temperature storage conditions. The special cycling test consisted of 30 cycles of 24 hours each from 283 K (50 F) to 347 k (165 F) followed by 30 cycles of 24 hours each from 283 K to 219 K (-65 F). Inspection of smokeless CHAPARRAL motors after 30 cold cycles revealed severe propellant grain cracking that, because of the increased burning surface, could result in catastrophic motor failure upon firing. This type of grain failure, with randomly located cracks, had not previously been found in other minimum signature propellants under development or in conventional double-base propellants used in Army tactical missiles. Because of the uniqueness and seriousness of the problem, and its potential impact on production of the CHAPARRAL minimum signature propellant motor, an intensive program was initiated jointly by the Army Propulsion Directorate and the propulsion contractor, Hercules Incorporated, to determine the cause of the grain failure and solve the problem. A number of possible failure mechanisms were proposed and investigated. The CHAPARRAL propellant involved in the grain failure is comprised of glycerol trinitrate (nitroglycerine) plasticizer; a crosslinked binder of polyglycoladpate, nictrocellulose, and polycaprolactone; a solid oxidizer; and inorganic additives. GRA

N81-12257# Ballistic Systems Div., Norton AFB, Calif.
THE INITIATION OF EXPLOSIVE CHARGES BY RAPID SHEAR

Robert B. Frey Jun. 1980 16 p refs
(AD-A090391) Avail: NTIS HC A02/MF A01 CSCL 19/1

Friction and/or shear have been suggested by many people as possible sources of ignition in solid explosives. Although these two mechanisms are usually considered to be distinct, on a microscopic scale they are essentially the same. On a microscopic scale, friction involves sliding interfaces and is described in terms of the coefficient of friction and the stress normal to the interface. The rate of heat generation at the surface is the product of the sliding velocity times the coefficient of friction times the normal stress. On a microscopic level, friction is caused by surface irregularities (asperities) which deform as the surfaces slide. The frictional heating is caused by viscoplastic work on the asperities. In this paper, I will consider the conditions required for ignition as the result of shear deformation and viscoplastic heating. GRA

N81-12258# Ballistic Systems Div., Norton AFB, Calif.
BURNING RATE TRANSITIONS FOR HMX BURNED AS A BINDERLESS PROPELLANT
Robert A. Fifer and James E. Cole Jun. 1980 15 p refs
(AD-A090389) Avail: NTIS HC A02/MF A01 CSCL 19/1

Composite (non-homogeneous) propellants containing crystalline HMX (cyclotetramethylene-tetranitramine) or the similar compound RDX (cyclotrimethylene-trinitramine) imbedded in a polymeric binder are gradually replacing homogeneous nitrocellulose-based propellants in many gun and rocket applications. Propellants containing HMX or RDX are commonly called nitramine propellants. A number of studies have been carried-out to determine the burn rate of pure HMX (1-4), using either large single crystals or pressed powder samples. Single crystal studies have only been successful to about 10 MPa, due to the tendency of the crystals to crack from the thermal stresses associated with burning at pressures higher than this. GRA

N81-12259# Naval Weapons Station, Yorktown, Va.
REPORT ON EXPLOSIVES MACHINING Interim Report
Robert Petersen Aug. 1980 18 p refs
(AD-A090732; NWSY-TR-80-2) Avail: NTIS HC A02/MF A01 CSCL 19/1

This study is to quantify, if possible, the hazardous effects of the machining variables. Initiation of an explosive is a thermal phenomena where input energy, regardless of its form (impact, shock, etc.), is converted to heat, increasing internal energy until an activation level is reached - an exothermic chemical reaction occurs providing heat for additional reactions to occur, continuing the cycle, until a 'runaway' condition exists. Therefore, if the effect of a machining variable is to raise explosive temperature, then it has increased the possibility for initiation to occur. Consequently, it was decided that an investigation of the heat producing effects of the machining variables, as manifested by explosive temperature increases, would provide the most beneficial insight as to their hazard-producing potential. GRA

N81-12260# IIT Research Inst., Chicago, Ill.
RECOMMENDED HAZARD CLASSIFICATION PROCEDURES FOR IN PROCESS PROPELLANT AND EXPLOSIVE MATERIAL Final Report
Hyla S. Napadensky, Ronald Pape, Richard Rinder, and Dan Satriana Sep. 1980 125 p refs
(Contract DAAK10-78-C-0029)
(AD-A090674; AD-E400474; IITRI-J6432-F; ARLCD-CR-80025) Avail: NTIS HC A06/MF A01 CSCL 19/1

A hazard classification procedure is described. The procedure is designed to characterize the potential hazards, fire and explosion effects, imposed by in-process chemical mixtures which exist in propellant and explosive manufacturing operations. Classification testing is divided into a sensitivity evaluation and an effects evaluation. Classifications which are assigned are nearly identical to the NATO/UN classes for storage and transport of explosive materials. GRA

N81-12261# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Service Lab.
THE VAPOR PHASE AUTOXIDATION OF UNSYMMETRICAL DIMETHYLHYDRAZINE AND 50 PERCENT UNSYMMETRICAL DIMETHYLHYDRAZINE 50 PERCENT HYDRAZINE MIXTURES Final Report, Jan. - Oct. 1979
Daniel A. Stone Apr. 1980 32 p refs
(AD-A090281; AFESC/ESL-TR-80-21) Avail: NTIS HC A03/MF A01 CSCL 07/3

The autoxidations of unsymmetrical dimethylhydrazine (UDMH) and a mixture of 50% UDMH and 50% hydrazine (50-50 blend) have been studied at pressures of several Torr in 44 cm reaction vessels and several ppm in a long path cell. With initial UDMH pressures of several Torr, autoxidation proceeded too slowly to be differentiated from natural decay processes. When the initial UDMH pressure was lowered to a few ppm, the addition of oxygen caused approximately first order decay with a half life of about 84 hours. The main oxidation product under these conditions was formaldehyde dimethylhydrazone. The 50-50 blend did not behave as two independent systems; instead, there were substantial positive synergistic effects observed. At concentrations of a few Torr of each component, the addition of oxygen resulted in a 10 to 20 fold increase in decay rate over that shown by UDMH or hydrazine by itself. At ppm concentration levels, the situation was similar for UDMH where a four-fold oxidation rate increase was observed when compared with a similar experiment with no hydrazine present. However, hydrazine oxidation in the 50-50 blend was somewhat slower that it was in a similar experiment with only hydrazine present. GRA

N81-12262# Illinois Univ. at Urbana-Champaign. Dept. of Aeronautical and Astronautical Engineering.
FLUID MECHANICAL PROCESSES OF DEFLAGRATION TO DETONATION TRANSITION IN BEDS OF POROUS REACTIVE SOLIDS Interim Technical Report, Jul. 1978 - May 1980
Stephen J. Hoffman and Herman Krier Mar. 1980 123 p refs
(Grant AF-AFOSR-3336-77; AF Proj. 2308)
(AD-A090558; AAE-80-2; UILU-ENG-80-0502; ITR-2; AFOSR-80-1064TR) Avail: NTIS HC A06/MF A02 CSCL 21/5

The fluid mechanical processes which characterize a transition from deflagration to detonation in granular beds of solid propellant have not at present been sufficiently refined to allow accurate modelling of the phenomenon. In an attempt to improve this situation, this report has investigated what might be considered basic mechanisms and consequences that arise from a set of assumptions for the governing and constitutive equations which take into account the two phase nature of this problem. A qualitative description of the flow process is made, based on observations obtained from DDT experiments. From this, certain conclusions are reached as to the properties needed by propellants to exhibit a deflagration to detonation transition (DDT). The numerical integration scheme itself is examined in detail in order to further understand the consequences of its use. GRA

N81-12263# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapons Systems Lab.
MOLECULAR LEVEL MODELING OF THE MECHANISM OF SHOCK INITIATION OF SOLID EXPLOSIVES
F. J. Owens Jun. 1980 15 p refs
(AD-A090427) Avail: NTIS HC A02/MF A01 CSCL 19/1

This work represents an attempt to consider on a fundamental level how shock or impact can cause chemical reactions in certain solids in order to gain insight into the factors which determine sensitivity to explosion. GRA

N81-12264# Army Armament Research and Development Command, Dover, N. J.
A REACTION MECHANISM IN THE SHOCK INITIATION OF DETONATION: A THEORETICAL STUDY
Jack Alster, Norman Slagg, Michael J. S. Dewar, James P. Ritchie, and Charles Wells Jun. 1980 14 p refs
(AD-A090357) Avail: NTIS HC A02/MF A01 CSCL 19/1

In a chain explosion, the initial chemical reaction follows one or more modes of reaction (1,2). The ensuing highly reactive transient species, commonly believed to be radicals, react with intact explosive molecules to produce more radicals which ultimately recombine and release energy sufficient to support a detonation wave. To achieve better control over the detonation process it is important to know the rate of the relatively slow, primary reaction step and the nature of the transient species produced in this step. When, in particular, a condensed explosive

experiences the high dynamic pressure of a strong, initiating shock wave, it may initially decompose via a bimolecular rather than a more commonly accepted unimolecular process. The present study was undertaken to examine this question in relation to the primar reaction step in liquid methyl nitrate undergoing shock initiation of detonation. GRA

N81-12265# Combustion Engineering, Inc., Windsor, Conn.
SYSTEM DESIGN OF ADVANCED CARBIDE FUEL Quarterly Progress Report, Oct. - Dec. 1979
S. A. Caspersson Dec. 1979 27 p refs
(Contract EN-76-C-02-2426)
(COO-2426-205; CE-FBR-80-019) Avail: NTIS HC A03/MF A01

Revisions to CB-1 (CB069) and CB-2 (CO081) carbide blanket assembly test TDD Volumes IB were made. All CB-1 (CB069) and CB-2 (CB081) pin and assembly drawings were revised and released for construction; these drawings have been sent to HEDL for procurement of hardware. Performance characteristics of blanket assemblies in the CDS Level II carbide heterogeneous core design were compared to several potential FTR irradiation positions for test definitions. Good matches in FTR for both carbide internal and radial blanket objectives were identified. DOE

N81-12266# Chem Systems, Inc., Fairfield, N.J.
DEVELOPMENT OF ALCOHOL-BASED SYNTHETIC TRANSPORTATION FUELS FROM COAL-DERIVED SYNTHESIS GASES Quarterly Progress Report, 1 Jan. - 31 Mar. 1980
15 Aug. 1980 77 p refs
(Contract DE-AC22-79ET-14858)
(DOE/ET-14858/2; QPR-2) Avail: NTIS HC A05/MF A01

Nineteen catalysts were prepared by (1) evaporation of metal nitrate citric acid solutions; (2) coprecipitation of nitrates with carbonates; (3) mechanical blending of the metal oxide (or nitrate) powders or (4) modification of commercial methanol synthesis catalysts. Fourteen catalysts were tested in either the Berty gradientless reactor or the plug flow reactor. Previously reported selectivities to liquid products were determined with a more refined gas chromatographic system. A preliminary technoeconomic assessment of three potential synthesis reactor systems (liquid fluidized, multitube, jacketed fixed bed or adiabatic fixed bed) was made which indicated that there are significant capital cost and operating cost savings associated with the use of a liquid fluidized reactor system. DOE

N81-12267# Operations Research, Inc., Silver Spring, Md.
ALTERNATIVE TRANSPORTATION FUELS
W. S. Askew, T. M. McNamara, and D. P. Maxfield 1980 16 p refs Presented at 5th Symp. on Automotive Propulsion Systems, Dearborn, Mich., 14-18 Apr. 1980
(Contract DE-AC02-78CS-54894)
(CONF-800419-5) Avail: NTIS HC A02/MF A01

The commercialization of alternative fuels was analyzed. Following a synopsis of U.S. energy use, the concept of commercialization, the impacts of supply shortages and demand inelasticity upon commercialization, and the status of alternative fuels commercialization to date in the U.S. are discussed. However, the level of consumption, the projected growth in demand, and the inordinate dependence upon foreign fuels dictate that additional fuel supplies in general be brought to the US energy marketplace. Commercialization efforts encompass a range of measures designed to accelerate the arrival of technologies or products in the marketplace. Such a union of willing buyers and willing sellers requires that three general conditions be met: product quality comparable to existing products; price competitiveness; and adequate availability of supply. DOE

N81-12268# Department of Energy, Bartlesville, Okla. Bartlesville Energy Technology Center.
COMPOSITION OF LIQUIDS FROM COALS OF DIFFERENT RANK
G. P. Sturm, Jr., J. S. Thomson, P. W. Woodward, and J. W. Vogh Sep. 1980 48 p refs
(DOE/BETC-RI-80/1) Avail: NTIS HC A03/MF A01

Eight coal liquids prepared from six coals of widely differing rank were compared with respect to their suitability as potential feedstocks for production of refined fuels. The coal liquids were prepared and upgraded by hydrogenation in a batch autoclave. The reaction conditions employed were selected to minimize hydrocarbon ring opening reactions and, at the same time, to produce most of the hydrocarbon liquids potentially available from the coals. The degree of hydrogenation of the raw coal liquids was varied as required to decrease the nitrogen content to about the same level and to provide a predominantly hydrocarbon liquid for analysis. In general, the results show that liquids of comparable suitability as feedstocks for production of refined fuels can be produced from coals of different rank. DOE

N81-12269# AMAF Industries, Columbia, Md.
COAL CONVERSION ENGINEERING ANALYSIS FOR CENTRAL HUDSON GAS AND ELECTRIC CORPORATION, DANSKAMMER GENERATING STATION, UNITS 3 AND 4 Final Report
1980 40 p refs
(Contract DE-AC01-79RG-10075)
(DOE/RG-10075/T1) Avail: NTIS HC A03/MF A01

The technical and economic feasibility of converting from oil to coal firing power plants was examined. Oil to coal conversion is technically feasible, but modifications or additions to existing plant equipment are required to meet coal handling needs and pollution control regulations. DOE

N81-12270# Department of Energy, Bartlesville, Okla. Energy Technology Center.
EXHAUST AND EVAPORATIVE EMISSIONS FROM GASOHOL-TYPE FUELS
T. M. Naman and J. R. Allsup Aug. 1980 13 p refs
(DOE/BETC-RI-80/7) Avail: NTIS HC A02/MF A01

An experimental study was conducted to determine the characteristics of gasohol-type fuels with respect to exhaust and evaporative emissions. Five fuels, 2 gasolines (reference and commercial unleaded) and 3 gasohols (90% gasoline/10% ethanol) were tested in a fleet of 10 late-model automobiles. Six were equipped with oxidation catalysts and 4 were equipped with three-way catalysts. The results obtained from the 1978 Federal test procedure indicate that the addition of ethanol to the base gasoline, whether it is a reference fuel (Indolene) or a commercial fuel, has measurable effects on exhaust and evaporative emissions. However, on the average, the magnitude of these effects was generally within the 1978 emission standards established by the EPA. DOE

N81-12271# Battelle Columbus Labs., Ohio.
ASSESSMENT OF THE POTENTIAL OF COLLOIDAL FUELS IN FUTURE ENERGY USAGE Final Report
25 Feb. 1980 121 p refs
(Contract DE-AC01-79ER-10062)
(DOE/ER-10062/T1) Avail: NTIS HC A06/MF A01

Pulverized coal has been an increasing important source of energy over the past century. Most large utility boilers, all modern coking plants, and many industrial boilers and blast furnaces employ pulverized coal as a major feed stream. In periods of oil shortages, such as during World Wars I and II, the concept of adding powered coal to oil for use in combustion equipment originally designed for oil was actively pursued but rarely used. Over this same period of time, there were attempts to use air suspensions of coal dust in diesel engines in Germany, and in turbines in various countries. The economic advantages to be enjoyed by substitution of powdered coal in oil are not generally realized. Oil costs at $30/bbl represent a fuel value of about $5.00/10 Btu; coal at $25/ton is equivalent to approximately $1.00/10 Btu. Although capital costs for the use of coal are higher than those associated with the use of oil, coal is clearly becoming the least costly fuel. DOE

N81-12272# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
STUDIES OF THE MECHANISMS OF COAL HYDROGENATION BY ELECTRON SPIN RESONANCE Quarterly Technical Progress Report, 1 Mar. - 31 May 1980
Ira B. Goldberg Jul. 1980 26 p refs
(Contract DE-AC22-80PC-30072)
(DOE/PC-30072/T1) Avail: NTIS HC A03/MF A01

Apparatus for high temperature-high pressure electron paramagnetic resonance measurements was constructed. It

characterizeed the performance of the microwave cavity, and carried out preliminary room temperature studies on coals and coal products. A system was constructed which can be used to study coal hydrogenation. The design philosophy, construction of the device, a preliminary discussion of its performance, and application of the cavity for room temperature studies on several varieties of coal are discussed. DOE

N81-12273# Colorado School of Mines, Golden. Dept. of Chemical and Petroleum Refining Engineering.
MECHANISMS AND KINETICS OF COAL HYDROGENATION Progress Report, Jan. - Jun. 1980
J. H. Gary, R. M. Baldwin, and R. L. Bain Jul. 1980 37 p refs
(Contract DE-AC01-79ET-14881)
(DOE/ET-14881/2) Avail: NTIS HC A03/MF A01

The objective of this task was to utilize the continuous flow bench scale coal liquefaction reactor system to investigate the rate of reaction of different coals at different processing conditions. Particularly, reaction rates at short residence times are to be measured in a Continuous Flow Stirred Tank Reactor and this information used to model reactions in the Plug Flow Reactor section of the unit. Work during the past six months was focused on completing modifications to the unit itself, as the bench scale system was originally designed to be operated at residence times just under 30 minutes. The new residence times are to be, at the least, just less than six minutes. The experimental portion will be a comparative study of the effect of different processing conditions on the rate of coal liquefaction. During the past six months, work on the continuous unit has been confined to modifications and system tuneup. DOE

N81-12274# International Research and Technology Corp., McLean, Va.
INDIRECT LIQUEFACTION OF COAL
30 Jun. 1980 47 p refs
(Contract DE-AC01-79EV-10291)
(DOE/EV-10291/T1) Avail: NTIS HC A03/MF A01

The most important potential environmental problems uniquely associated with indirect liquefaction appear to be related to the protection of occupational personnel from the toxic and carcinogenic properties of process and waste stream constituents, the potential public health risks from process products, by products and emissions and the management of potentially hazardous solid wastes. The seriousness of these potential problems is related partially to the severity of potential effects (i.e., human mortality and morbidity), but even more to the uncertainty regarding (1) the probable chemical characteristics and quantities of process and waste streams; and (2) the effectiveness and efficiencies of control technologies not yet tested on a commercial scale. Based upon current information, it is highly improbable that these potential problems will actually be manifested or pose serious constraints to the development of indirect liquefaction technologies, although their potential severity warrants continued research and evaluation. DOE

N81-12275# Los Alamos Scientific Lab., N. Mex.
THERMOCHEMICAL CYCLES: A NEW METHOD OF PRODUCING HYDROGEN
K. E. Cox Aug. 1980 4 p refs
(Contract W-7405-eng-36)
(LASL-80-26) Avail: NTIS HC A02/MF A01

The concept of using hydrogen as a universal fuel is considered. Various aspects of hydrogen production are described with particular emphasis on hydrogen production from water. The effects of catalysts, organic solvents, complexing agents, and molten salts are examined and their contribution to the basic understanding of the thermochemical cycles of hydrogen production are evaluated. R.C.T.

N81-12276# Sandia Labs., Albuquerque, N. Mex.
STABILITY AND COMPATIBILITY STUDIES WITH THE INORGANIC EXPLOSIVE 2-(5-CYANOTETRAZOLATO) PENTAAMINECOBALT (3) PERCHLORATE (CP)
T. M. Morenus, P. K. Morenus, D. H. Huskisson, and R. M. Merrill 1980 28 p refs Presented at ADPA Compatibility Meeting, Blacksburg, Va., 13 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0965c; CONF-801048-5) Avail: NTIS HC A03/MF A01

The organic explosive 2-(5-Cyanotetrazolato) pentaamminecobalt(III) perchlorate (CP) was developed for applications involving deflagration-to-detonation transition. Previously the primary explosives lead azide and lead styphnate were used. By using the rate of formation of cobalt(II) as the prime stability measurement for CP no reaction above baseline was observed at temperatures at or below 80 C. At 120 C, approximately 2.2% reaction measured after three years with the concentration approaching a constant value. With the typical materials of construction in low voltage detonators, no compatibility problems with CP were found. Adhesives such as epoxies also show good compatibility characteristics with CP. The only material tested thus far that exhibits potential compatibility problems with CP was copper. DOE

N81-12277# Brookhaven National Lab., Upton, N. Y. Process Sciences Div.
THE FLASH HYDROGENATION OF BIOMASS
Meyer Steinberg 1980 7 p refs Presented at the 11th Biomass Thermochem. Conversion Contractors Meeting, Richland, Wash., 23-24 Sep. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28297; CONF-800973-2) Avail: NTIS HC A02/MF A01

It is proposed to obtain process chemistry information on the rapid hydrogenation of biomass (wood and other agricultural products) to produce light liquid and gaseous hydrocarbon fuels and feedstocks. The process is referred to as Flash Hydropyrolysis. The information will be of use in the design and evaluation of processes for the conversion of biomass to synthetic fuels and petrochemical feedstocks. Author

N81-12278# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ALTERNATIVE PROCESS SCHEMES FOR COAL CONVERSION
Michael J. Sansone, Richard Sapienza, and William Stieger Apr. 1980 50 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51233; PR-4) Avail: NTIS HC A03/MF A01

The separation of H2/CH4 and H2/CH4/CO mixtures resulting from coal gasification processes is discussed. The separation calculations were performed for ideal, cryogenic, clathrate (gas-hydrate), and absorption/stripping separation processes. The cryogenic separation indicates the least energy requirement. A review of existing and developing coal gasification processes is presented. The relative merits of gasifier type, heating method, operating mode, process conditions, and gasifying medium are considered. M.G.

N81-12279# Argonne National Lab., Ill. Special Projects Group.
GRAIN ETHANOL AS A PETROLEUM SUBSTITUTE: A PERSPECTIVE
T. G. Alston Apr. 1980 29 p refs
(ANL/SPG-9) Avail: NTIS HC A03/MF A01

The use of grain ethanol to supplement petroleum supplies is examined. Upper bound prices for feed grains resulting from gasohol tax exemptions are estimated. It is concluded that grain price increases could be substantial. Industrial uses constitute a more economical market for grain ethanol, one in which the product is now competitive with ethanol derived from petroleum and natural gas liquids. Without tax exemptions for gasohol, grain ethanol would now be displacing petroleum in the industrial market at a net economic gain, rather than in the fuel market at a net economic loss. Results indicate that this industrial market for ethanol could grow significantly, principally by use of grain ethanol as an intermediate in production of chemicals now derived from petroleum and natural gas. M.G.

N81-12280# Argonne National Lab., Ill. Chemical Engineering Div.
SUPPORT STUDIES IN FLUIDIZED-BED COMBUSTION Annual Report, Oct. 1978 - Sep. 1979
Irving Johnson, K. M. Myles, W. M. Swift, S. H. D. Lee, J. A. Shearer, A. A. Siczek, F. G. Teats, W. I. Wilson, W. A. Boyd, E.

B. Smyk et al 1979 85 p refs
(Contracts W-31-109-eng-38; EPA-IAG-D5-E681)
(ANL/CEN/FE-79-14) Avail: NTIS HC A05/MF A01

The technical data base needed for the design of granular filters to remove gaseous alkali metal compounds from hot flue gas, with either diatomaceous Earth or activated bauxite used as a sorbent was developed. The effect of NaCl vapor concentration in flue gas on the sorption performance of diatomaceous earth and activated bauxite was studied. The ultimate NaCl vapor sorption capacities of diatomaceous Earth and activated bauxite was obtained. R.C.T.

N81-12281# Groupe de Recherche de Chimie Physique de la Combustion, St. Julien l'Ars (France).
STUDY OF SPACE MICROPROPULSION BY HYDRAZINE THERMAL DECOMPOSITION. LABORATORY TESTS [ETUDE DE LA MICROPROPULSION SPATIALE PAR DECOMPOSITION TECHNIQUE DE L'HYDRAZINE. ESSAIS DE LABORATOIRE]
Mohamed Faleh, Alain Bourreau, Jean-Louis Carreau, Jean-Claude Goudeau, and Michel-Louis Bernard Paris Association Aeronautique et Astronautique de France 1980 34 p refs In FRENCH; ENGLISH summary Sponsored by CNRS
(AAAF-NT-80-28; ISBN-2-7170-0624-9) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

A constant volume static reactor was used to study the pressure increase with time of the decomposition evolved gases. Several decomposition supporting materials were studied between 300 and 790 C. The influence of the temperature on the reaction velocity and NH3 decomposition is shown, and kinetic mechanisms are suggested. Author (ESA)

N81-12282# Propellants, Explosives and Rocket Motor Establishment, Westcott (England).
THE USE OF AN ARC IMAGE FURNACE FOR SOLID PROPELLANT IGNITION STUDIES. AN UNDERGRADUATE STUDENT REPORT
Jacqueline Bernadette Dawes London May 1980 23 p refs
(PERME-MEMO-111; BR74602) Avail: NTIS HC A02/MF A01

An arc image furnace was used to test the ignition delay of rocket propellant under varying conditions of heat flux and pressure, and the results compared with other methods. Some of the composite propellant tests show that when the differences due to reflectivity are reduced by coating, the ignition delay time of the various batches are very similar. Other tests made with a double base cordite propellant show that the pressure increase results in more rapid ignition, specially at high flux levels. Author (ESA)

N81-12988*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COAL GASIFIER COGENERATION POWERPLANT PROJECT
Lloyd I. Shure and Harvey S. Bloomfield *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 123-131 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 21D

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-12283*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
BEAM CONNECTOR APPARATUS AND ASSEMBLY Patent Application
Georg vonTiesenhausen, inventor (to NASA) Filed 8 Oct. 1980 13 p
(NASA-Case-MFS-25134-1; US-Patent-Appl-SN-195226) Avail: NTIS HC A02/MF A01 CSCL 13B

A connector apparatus and assembly is described for connecting beams and the like structural members which is particularly advantageous for connecting two members together when moved laterally into place. The connector apparatus requires no relative longitudinal movement between the ends of the beams or members being connected to make a connection joint. The connector apparatus includes a receptacle member and a connector housing carried by opposed ends of the structural member being connected wherein a spring-loaded connector member is carried by the connector housing which may be released for extension and engagement into the receptacle member. NASA

N81-12284# Committee on Science and Technology (U. S. House).
OVERSIGHT HEARING: UNITED STATES METRIC BOARD
Washington GPO 1979 140 p Hearing before the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol., 96th Congr., 1st. Sess., no. 83, 26 Nov. 1979
(GPO-56-236) Avail: Subcommittee on Science, Research and Technology

The importance of the Metric Board's functions and the problems associated with it during the early months of its existence were reviewed. A review of the progress made in transition to metric from present standards of measurement is presented. The effectiveness of the Metric Act was determined. T.M.

N81-12285# Army Materials and Mechanics Research Center, Watertown, Mass.
PROCEEDINGS OF THE ARMY SYMPOSIUM ON SOLID MECHANICS. DESIGNING FOR EXTREMES: ENVIRONMENT, LOADING, AND STRUCTURAL BEHAVIOR Final Report
Sep. 1980 389 p refs Symp. held at Cape Cod, Mass., 30 Sep. - 2 Oct. 1980
(AD-A090684; AMMRC-MS-80-4) Avail: NTIS HC A17/MF A01 CSCL 05/1

Topics concerning hardware systems, dynamic response, and composite structures are discussed. Other topics on projectile phenomena include motion analysis, impact, deformation, fracture investigations, and compression tests. E.D.K.

N81-12286# Army Materials and Mechanics Research Center, Watertown, Mass.
OPENING SESSION ADDRESSES PRESENTED AT THE ARMY SYMPOSIUM ON SOLID MECHANICS. DESIGNING FOR EXTREMES: ENVIRONMENT, LOADING, AND STRUCTURAL BEHAVIOR Final Report
Sep. 1980 26 p refs Presented at Cape Cod, Mass., 30 Sep. - 2 Oct. 1980
(AD-A090686; AMMRC-MS-80-6) Avail: NTIS HC A03/MF A01 CSCL 05/1

This document contains copies of the addresses presented during the opening session of the Army Symposium on Solid Mechanics, 1980. This meeting was held at Bass River (Cape Cod), Massachusetts during September 30-October 2, 1980 and was conducted on the theme 'Designing for Extremes: Environment, Loading and Structural Behavior'. GRA

N81-12287# Army Materials and Mechanics Research Center, Watertown, Mass. Mechanics and Engineering Lab.
WORK-IN-PROGRESS PRESENTED AT THE ARMY SYMPOSIUM ON SOLID MECHANICS, 1980, DESIGNING FOR EXTREMES: ENVIRONMENT, LOADING, AND STRUCTURAL BEHAVIOR Final Report
Sep. 1980 108 p refs Conf. held at Cape Cod, Mass., 29 Sep. - 2 Oct. 1980
(AD-A090685; AMMRC-MS-80-5) Avail: NTIS HC A06/MF A01 CSCL 05/1

Work-in-Progress was presented at the Army Symposium on Solid Mechanics, 1980. Designing for Extremes: Environment, Loading, and Structural Behavior, held at Bass River (Cape Cod), Massachusetts, 29 September through 2 October 1980 were presented. GRA

N81-12288# Bendix Corp., Kansas City, Mo.
DEBURRING: TECHNICAL CAPABILITIES AND COST-EFFECTIVE APPROACHES, LESSONS 5 AND 6
LaRoux K. Gillespie Jun. 1980 90 p refs

(Contract DE-AC04-76DP-00613)
(BDX-613-2382) Avail: NTIS HC A05/MF A01

The effective plant wide reduction of deburring costs can best be achieved by considering the following factors: (1) determine the people who should be involved in a plant-wide review of deburring, (2) define the approach to be used in a plant-wide review of deburring, (3) provide some form of training for both engineers and production workers, (4) establish in-plant standards for burrs and deburring, and (5) understand the capabilities of the available deburring equipment. The key to plant wide control of deburring costs lies in considering deburring as integral as drilling or milling to the manufacturing process, in respecting the difficulty that deburring presents, in recognizing those who contribute to the success of deburring operations, and in using the large quantity of data that already exists.E.D.K.

N81-12289# Bendix Corp., Kansas City, Mo.
WHOLE 'NEW WORLD OF MINIATURE TECHNOLOGY
LaRoux K. Gillespie Jul. 1980 56 p refs Presented at Soc. of Manuf. Engrs. Minitech 1, Chicago, May 1979
(Contract DE-AC04-79DP-00613)
(BDX-613-2277; CONF-790568-2) Avail: NTIS HC A02/MF A01

Some of the current capabilities in the manufacture of miniature metal piece parts or miniature features in larger piece parts are discussed. DOE

N81-12290# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SEISMIC RESPONSE ANALYSIS FOR STRUCTURES WITH NON-ORTHOGONAL MODES
W. F. Yau 1980 9 p refs Presented at ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract DE-AC09-76SR-00001)
(DP-MS/79-78; CONF-800804-21) Avail: NTIS HC A02/MF A01

For seismic analysis of structures in nuclear industry, the spectrum method of modal combination acceptable to the U.S. Nuclear Regulatory Commission is applicable only to systems with orthogonal natural modes. When a structure with frequency dependent boundary conditions is set in motion, its natural modes of vibration are generally nonorthogonal. Based on such a structure, the spectrum method of modal composition is generalized to include systems with nonorthogonal modes. The generalized expression for the participation factor of each model is reducible to that prescribed by NRC, when the natural modes of the system are orthogonal. To illustrate the generalized method, the model responses of a simple structure are analyzed in detail. DOE

N81-12291# Siemens A.G., Munich (West Germany). Forschungslab.
PHYSICAL AND CHEMICAL PROCESSES FOR THE GENERATION OF ONE MICROMETER STRUCTURES Final Report, Dec. 1977
Leonhard Mader Bonn Bundesministerium fuer Forschung und Technologie Nov. 1979 61 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie (BMFT-FB-T-79-51; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.40

Various processes for the realization of fine structures in insulators and metal layers on silicon wafers were studied. Wet chemical etching of silicon dioxide and aluminum layers, plasma etching of polysilicon layers, ion beam etching of silicon dioxide and polysilicon layers, and a lift-off technique for metal pattern generation were tried. Test structures and functioning integrated circuits (memory cells, CCD'S) with minimum dimensions of 1.5 micrometers were realized using these methods of pattern generation. The advantages and problems associated with the different techniques are briefly outlined and discussed.
Author (ESA)

N81-12292# European Space Agency, Paris (France).
A NEW METHOD OF ROUNDNESS MEASUREMENT BY CAPACITATIVE DETECTORS Thesis - Univ. Pierre et Marie Curie
Bernard Foulon Oct. 1980 119 p refs Trans. into ENGLISH of "Nouvelle Methode de Cylindrometrie par Capteurs Capacitifs", Rept. ONERA-NT-1979-9 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-23523
(ESA-TT-635; ONERA-NT-1979-9) Avail: NTIS HC A06/MF A01

A high precision technique for roundness measurements of nearly cylindrical mechanical parts by the use of capacitive detectors was developed. The general problems encoutered in roundness measurements and the limitations of existing systems are presented. The apparatus and test results are described. A 3 mm radius cylinder was measured with a relative accuracy of 0.0001. Theoretically the method makes it possible to determine the exact roundness of an unknown section. Author (ESA)

N81-12293# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLE/SHIPS IN MARINE ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Guy E. Habercom, Jr. Aug. 1980 256 p Supersedes NTIS/PS-79/0936; NTIS/PS-78/0862
(PB80-814528; NTIS/PS-79/0936; NTIS/PS-78/0862) Avail: NTIS HC $30.00/MF $30.00 CSCL 13J

This bibliography contains 251 citations in which surface effect ships and vehicles and their aerodynamic characteristics are investigated. Technical and operational characteristics are reviewed. GRA

N81-12294# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLES AND SURFACE EFFECT: GENERAL STUDIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1972 - Jul. 1980
Guy E. Habercom, Jr. Aug. 1980 185 p Supersedes NTIS/PS-79/0946; NTIS/PS-78/0874
(PB80-814551; NTIS/PS-79/0946; NTIS/PS-78/0874) Avail: NTIS HC $30.00/MF $30.00 CSCL 13J

The bibliography contains 180 citations in which the design of surface effect vehicles, their utilization, and their aerodynamic characteristics are investigated. Vehicles or ships in marine environments are not included. GRA

N81-12295# National Technical Information Service, Springfield, Va.
SURFACE EFFECT VEHICLES/SHIPS IN MARINE ENVIRONMENTS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1980
Guy E. Habercom, Jr. Jul. 1980 207 p Supersedes NTIS/PS-79/0937; NTIS/PS-78/0863
(PB80-814510; NTIS/PS-79/0937; NTIS/PS-78/0863) Avail: NTIS HC $30.00/MF $30.00 CSCL 13J

The bibliography contains 202 citations in which surface effect ships and vehicles and their aerodynamic characteristics are investigated. Technical and operational characteristics are reviewed. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N81-12296*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ANALYSIS OF SHORT PULSE AND DUAL FREQUENCY RADAR TECHNIQUES FOR MEASURING OCEAN WAVE SPECTRA FROM SATELLITES
Frederick C. Jackson Oct. 1980 58 p refs Submitted for publication
(NASA-TM-82011) Avail: NTIS HC A04/MF A01 CSCL 17I

Scanning beam microwave radars were used to measure ocean wave directional spectra from satellites. In principle, surface wave spectral resolution in wave number can be obtained using either short pulse (SP) or dual frequency (DF) techniques; in either case, directional resolution obtains naturally as a conse-

quence of a Bragg-like wave front matching. A four frequency moment characterization of backscatter from the near vertical using physical optics in the high frequency limit was applied to an analysis of the SP and DF measurement techniques. The intrinsic electromagnetic modulation spectrum was to the first order in wave steepness proportional to the large wave directional slope spectrum. Harmonic distortion was small and was a minimum near 10 deg incidence. NonGaussian wave statistics can have an effect comparable to that in the second order of scattering from a normally distributed sea surface. The SP technique is superior to the DF technique in terms of measurement signal to noise ratio and contrast ratio. Author

N81-12297*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VECTOR ANALOGUES OF THE MAGGI-RUBINOWICZ THEORY OF EDGE DIFFRACTION
Robert Meneghini, Peter Shu, and John Bay (Systems and Applied Science Corp., Bladensburg, Md.) Oct. 1980 27 p refs
(NASA-TM-82024) Avail: NTIS HC A03/MF A01 CSCL 20N

The Maggi-Rubinowicz technique for scalar and electromagnetic fields is interpreted as a transformation of an integral over an open surface to a line integral around its rim. Maggi-Rubinowicz analogues are found for several vector physical optics representations. For diffraction from a circular aperture, a numerical comparison between these formulations shows the two methods are in agreement. To circumvent certain convergence difficulties in the Maggi-Rubinowicz integrals that occur as the observer approaches the shadow boundary, a variable mesh integration is used. For the examples considered, where the ratio of the aperture diameter to wavelength is about ten, the Maggi-Rubinowicz formulation yields an 8 to 10 fold decrease in computation time relative to the physical optics formulation. Author

N81-12298*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTI-MODE HORN ANTENNA SIMULATION
Louis R. Dod and Jane D. Wolf (Sigma Data Services Corp., Silver Spring, Md.) May 1980 19 p refs
(NASA-TM-80705) Avail: NTIS HC A02/MF A01 CSCL 20N

Radiation patterns were computed for a circular multimode horn antenna using waveguide electric field radiation expressions. The circular multimode horn was considered as a possible reflector feed antenna for the Large Antenna Multifrequency Microwave Radiometer (LAMMR). This horn antenna uses a summation of the TE sub 11 deg and TM sub 11 deg modes to generate far field primary radiation patterns with equal E and H plane beamwidths and low sidelobes. A computer program for the radiation field expressions using the summation of waveguide radiation modes is described. The sensitivity of the multimode horn antenna radiation patterns to phase variations between the two modes is given. Sample radiation pattern calculations for a reflector feed horn for LAMMR are shown. The multimode horn antenna provides a low noise feed suitable for radiometric applications. Author

N81-12299 Electronics Research Lab., Adelaide (Australia).
A COMPUTER BASED IONOSPHERIC SOUNDING AND HF NOISE MEASURING SYSTEM
G. F. Earl Sep. 1980 26 p
(ERL-0146-TR; AR-002-012) Avail: NTIS HC A03/MF A01

A system for the automated collection of ionospheric backscatter sounding and HF noise measurement data is described. The system was configured around a PDP 11/40 minicomputer and modified Barry Research FMCW sounding equipment. The real time digital signal processing associated with the backscatter sounder and noise measurement systems is discussed. The data are displayed and recorded in a calibrated mode, and examples are presented. Author

N81-12300# Oakland Univ., Rochester, Mich. School of Engineering.
A UNIFORM REPRESENTATION OF SINGLE AND MULTI-STAGE INTERCONNECTION NETWORKS USED IN SIMD MACHINES Interim Report
D. K. Pradhan and K. L. Kodandapani (NCR Corp., Wichita, Kan.) Jun. 1980 52 p refs
(Contract F49620-79-C-0119; AF Proj. 2304)
(AD-A089688; AFOSR-80-0950TR) Avail: NTIS HC A04/MF A01 CSCL 17/2

A switching theoretic framework for the study of interconnection networks is developed. An equivalence relationship between networks is defined. Single stage and multi-stage networks that are particularly useful for single instructions multiple data stream (SIMD) machines are studied. It is shown that the networks form two distinct equivalence classes under this definition of equivalence relationship. It is shown that any multi-stage network can be easily modified to realize the permutations that are admissable by any other network which is equivalent to it. GRA

N81-12301# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ADAPTIVE HF PROPAGATION PATH UTILIZATION Final Report, 11 Jun. - 30 Sep. 1979
Ashok K. Gupta and Mario D. Grossi Hanscom AFB, Mass. AFGL 30 Jun. 1980 108 p refs
(Contract F19628-79-C-0137; AF Proj. 4643)
(AD-A090023; AFGL-TR-79-0236) Avail: NTIS HC A06/MF A01 CSCL 17/2

Detailed knowledge of the characteristics of HF propagation is an essential requirement to a better utilization of these paths in reliable communications. Recent advances in HF path characterization as well as in communication equipment, coding schemes, and microprocessor technology make it possible to conceive approaches of adaptive utilization of HF propagation that promise a substantial improvement upon present-day HF circuit performance. This recently acquired expertise includes the following advances: (a) better understanding of the multipath spread and Doppler spread characteristics of HF propagation paths in several path configurations (midlatitude paths, transequatorial paths, transauroral paths, etc.); (b) availability of frequency-agile HF transmitters and receivers; (c) availability of high-speed sounding techniques, such as the digisonde approach; (d) availability of microprocessor logics for real-time evaluation of channel performance, for making decisions on the required diversity and for carrier frequency selection.; (e) availability of coding schemes, such as the M-ary codes, that maximize the data rate for the selected signalling approach. This report illustrates an adaptive method that makes it possible to transmit a data rate of 24 kilobits/sec with an error rate of .0004 (therefore suitable for high-quality digital voice) in a single-hop ionospheric path established in midlatitude or across the aurora belt. GRA

N81-12302# Hycom, Inc., Irvine, Calif.
TACTICAL VIDEO DISPLAY Interim Technical Report, 10 Jun. - 10 Dec. 1979
T. A. Gielow and R. H. Holly Sep. 1980 50 p refs
(Contract DAAK20-79-C-0251; DA Proj. 1L1-62705-AH-94)
(AD-A089992; DELET-TR-79-0251-1; ITR-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

Hycom has completed the first phase of a development program to design and fabricate a 512 x 640 line electroluminescent display. The program entails two major areas of efforts: the first is to improve the display panel and the second is to improve the drive electronics. The display panel in this program is larger and is of higher resolution than any previous TFEL panel. The panel also incorporates a black layer to absorb refracted light and to enhance the contrast. The drive circuitry effort is to develop circuitry which will provide video modulation with low power dissipation. The objective is to design a driver that can overcome the capacitive and resistive parameters of the panel while still being implementable in a compact and inexpensive form. GRA

N81-12303# City Univ. of New York, N. Y. Dept. of Physics.
TRANSMISSION OF ELECTROMAGNETIC RADIATION THROUGH NON-PLANAR LAYERED MEDIA Final Report
Louis A. Deacetis Mar. 1980 44 p refs
(Grant AF-AFOSR-0035-79; AF Proj. 2301)
(AD-A089937; AFOSR-80-0757TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

An investigation of transmission of electromagnetic radiation through non-planar media consisting of several layers of dielectric has begun. A library search of recent theoretical and experimen-

tal work in this area was conducted, and a theoretical study of the exact solutions to transmission through layered cylindrical and spherical media is underway. The library survey did not uncover any systemic experimental investigations in this area. Attempts at expanding exact solutions to obtain suitable approximations to the plane-layer cases have thus far not been successful. Several computer programs not generally available were developed to generate the spherical and half-integer Bessel Functions of both the first and second kind and are included in this report. Calculations using these functions are currently underway. GRA

N81-12304# University of Southeastern Massachusetts, North Dartmouth.
OVERLAPPED SUBARRAYING TECHNIQUES Final Report
Paul R. Caron 30 Jun. 1980 37 p refs
(Grant AF-AFOSR-0112-79; AF Proj. 2305)
(AD-A089693; AFOSR-80-0745TR) Avail: NTIS HC A03/MF A01 CSCL 09/5

In applications of phased array antennas for limited scan, sub-array schemes prove to be useful in reducing costs and space. An investigation of two such techniques, namely the space fed lens and a constrained feed system were conducted. Radiation patterns for a flat space-fed lens have been obtained and it has been shown that this system compares favorably in performance with the spherical lens, the latter being more difficult and expensive to construct in a space environment. Results on the effects of surface perturbations in the lens and on techniques for phase correcting at the feed for these are presented. GRA

N81-12305# Army Missile Command, Redstone Arsenal, Ala.
FREQUENCY DIVERSE TRACKING/GUIDANCE MILLIMETER RADAR ADAPTED TO TARGET ACQUISITION
P. Martin Alexander Jun. 1980 15 p refs
(AD-A090355) Avail: NTIS HC A02/MF A01 CSCL 19/5

Millimeter wave radar fire control for ground-to-ground tactical weapons provides a compromise between the resolution offered by electrooptical and infrared systems and the adverse environment (fog, battlefield smokes) penetrability which is characteristic of microwave systems. The effectiveness of millimeter sensors would be greatly enhanced if they could also be used to classify radar returns resulting from clutter, tanks, personnel carriers, etc., and particularly from stationary targets. GRA

N81-12306# Institute for Telecommunication Sciences, Boulder, Colo. Dept. of Commerce.
PROPAGATION IN A TROPOSPHERIC DUCT WITH A SINGLE-STEP DISCONTINUITY IN THE REFRACTIVE INDEX IN THE DIRECTION OF PROPAGATION Final Report, Nov. - May 1980
R. H. Ott Wright-Patterson AFB, Ohio AFWAL Jun. 1980 34 p refs
(AFOSR MIPR-GY1175-79-N-2119)
(AD-A090544; ILIR-1792; AFWAL-TR-80-1138) Avail: NTIS HC A03/MF A01 CSCL 20/14

A Green's function approach is used to derive an expression for the field inside a laterally inhomogeneous duct. The laterally inhomogeneous duct is assumed to have a single step, and convergence criteria for the step size and number of modes are discussed. GRA

N81-12307# Rochester Univ., N. Y. Dept. of Electrical Engineering.
AN ANALYSIS OF THE VARIOUS METHODS USED TO ANALYZE RADIATION FROM THE THIN WIRE E FIELD INTEGRAL EQUATION
Tapan K. Sarkar Mar. 1980 28 p refs
(Contract N00014-79-C-0598)
(AD-A090488; TR-80-2; TR-1) Avail: NTIS HC A03/MF A01 CSCL 20/14

In this paper we analyze the numerical aspects of the various methods that have been used to analyze thin wire antenna problems. First we derive some properties of the thin wire E-field integral operator. Based on those properties we unify the various iterative methods used to find current distribution on thin wire structures. An attempt has been made to resolve the question of numerical stability associated with various entire domain and subdomain expansion functions in Galerkin's method. It has been shown that the sequence of solutions generated by the iterative methods monotonically approaches the exact solution provided the excitation chosen for these problems are in the range of E-field operator. Such a statement does not hold for Galerkin's method since the inverse operator is unbounded. Moreover if the excitation function is not in the range of the operator the sequence of solutions form an asymptotic series. Examples have been presented to illustrate this point. GRA

N81-12308# California Univ., Berkeley. Electronics Research Lab.
ELECTROMAGNETIC WAVES SCATTERING BY BURIED DIELECTRIC OBJECTS Final Report, 1 Nov. 1976 - 14 Jun. 1980
S. K. Chang and K. K. Mei 1980 51 p refs
(Grant DAAG29-77-G-0021)
(AD-A090582; ARO-14270.9-EL) Avail: NTIS HC A04/MF A01 CSCL 20/3

Time harmonic modal electromagnetic fields in two-medium half spaces are investigated. For practical and numerical considerations, the primary sources of the modal fields are chosen to be the spherical multipoles, and the potential vectors are z-directed. It is shown that modal fields of such combination are not able to represent a conventional spherical modal field. The horizontal rotating potentials are added to ensure proper representation and fast convergence. The recurrence relations which transform the spherical Hankel-Lengendre functions into the Fourier-Bessel integrals are derived. The secondary fields of the Sommerfield's type are obtained for all spherical multipole sources, and the added horizontally rotating potentials. The combination of the modal fields are capable of representing arbitrary electromagnetic fields resulting from radiation and scattering problems. GRA

N81-12309# New York Univ., N. Y. Courant Inst. of Mathematical Sciences.
SOLVING THE HELMHOLTZ EQUATION FOR EXTERIOR PROBLEMS WITH VARIABLES INDEX OF REFRACTION, 1
Gregory A. Kriegsmann and Cathleen S. Morawetz 1980 36 p refs Prepared in cooperation with Nebraska Univ., Lincoln
(Contracts F49620-79-C-0193; N00014-76-C-0439)
(AD-A090550; AFOSR-80-1012TR) Avail: NTIS HC A03/MF A01 CSCL 20/14

A new technique for numerically solving the reduced wave equation on exterior domains is presented. The method is basically a relaxation scheme which exploits the limiting amplitude principle. A modified boundary condition at 'infinity' is also given. The technique is tested on several model problems: the scattering of a plane wave off a metal cylinder, a metal strip, a Helmholtz resonator, an inhomogeneous cylinder (lens), and a nonlinear plasma column. The results are in good qualitative agreement with previously calculated values. In particular, the numerical solutions exhibit the correct refractive and diffractive effects at moderate frequencies. GRA

N81-12310# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
THEORETICAL AND EXPERIMENTAL STUDY OF RADAR SCATTERING AND SIMULATION. PART 1: THEORY Final Report, 5 Jan. 1977 - 4 Jul. 1980
Adrian K. Fung Aug. 1980 43 p refs
(Grant DAAG29-77-G-0075)
(AD-A090500; ARO-14043.10-GS) Avail: NTIS HC A03/MF A01 CSCL 17/9

The objective is to develop theoretical radar backscatter models for targets needed for radar simulation. In particular, vegetation covered terrain has been given special attention. The models should provide polarization, frequency and angular variations of the radar backscattering coefficient which is an input parameter to the equation governing the graytone level of radar images. Theoretically, scattering from a natural terrain such as a vegetation canopy over soil comes from three processes: (a) volume scattering from the vegetation, (b) surface scattering from the underlying soil and (c) combined volume and surface scattering due to scattered waves which have interacted with both soil and vegetation before returning to radar. Results summarized in this report deal mainly with improvement and

new findings in (a) and (b); an attempt to account for (c) has been carried out for an emission model. GRA

N81-12311# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ACOUSTOELECTRIC DEVICES: A NEW TECHNOLOGY FOR WAVEFORM-AGILE RADAR
R. W. Ralston and J. H. Cafarella 10 Sep. 1980 18 p refs
Presented at the AIAA Strategic/Tactical Missile System and Space Sciences Meeting, 10 Sep. 1980
(AD-A090646) Avail: NTIS HC A02/MF A01 CSCL 17/9

This paper proposes a waveform-agile radar, analyzes the signal-processing required, and describes the state of the art of *two new acousto-electric devices needed for the agile radar:* the memory correlator, which provides electronically programmable matched filtering of individual pulses, and the coherent *integrator, which is being developed to provide electronically* programmable Doppler processing. The electronic programmability of these compact wideband analog devices gives them unique *functional capabilities which may allow future tactical systems* to achieve electronic counter measure resistance and low probability of intercept by facilitating the use of continually changing wideband waveforms. GRA

N81-12312# *General Electric Co., Utica, N. Y. Aircraft* Equipment Div.
WIDEBAND MULTIPLEX SYSTEM Final Report
Jun. 1980 108 p
(Contract N62269-79-C-0037)
(AD-A090770) Avail: NTIS HC A06/MF A01 CSCL 17/2

The objective of this contract was to design and assemble a wideband video multiplexing system which would provide a *means for distributing several wideband video and sync signals* on a single coaxial cable to multiple video display terminals. Frequency Division Multiplexing (FDM) is employed in this system. *It divides a particular portion of the RF spectrum into discrete* information channels. Each channel contains separate composite video and sync signals for subsequent display. Five separate *channels are provided with an assigned channel bandwidth of* 6 MHz per channel. Channel frequency is determined by the modulator (transmitter) unit, which generates the appropriate RF *carrier. Channel assignments conform to the commercial TV band* and include channels 2, 4, and 5 for bus 1 and channels 7 and 9 for bus 2. Selection of these channels insures sufficient channel spacing to minimize interference. GRA

N81-12313# Army Communications Research and Development Command, Fort Monmouth, N. J. Communication Systems Center.
CORRELATION AND PREDICTION OF PROPAGATION TIME-DELAYS ALONG EARTH-SPACE LINKS
Haim Soicher Jun. 1980 14 p refs
(AD-A090441) Avail: NTIS HC A02/MF A01 CSCL 20/14

High precision in radar detection, in earth-satellite orbit determination, and in satellite navigation necessitates that the *signal data used be corrected for the errors imposed by the* ionosphere. Signal time-delays, or equivalently range errors, are always encountered in transionospheric measurements because the electromagnetic propagation velocity in the medium is slightly less than the free-space velocity. For frequencies at VHF and *above, an excess time delay is inversely proportional to the* square of the frequency and is directly proportional to the integrated electron density along the propagation path (i.e., total *electron content (TEC) measured in units of e1/m squared). Thus,* if TEC is known, or is measured in real time, a perfect correction to ranging can be performed. The TEC may be measured in real *time, provided the user has dual-frequency capabilities. Since* the ionosphere is a dispersive medium, the relative time delays (or phase differences) between the two frequencies may be used to eliminate the error introduced by the TEC. GRA

N81-12314# Army Combat Surveillance and Target Acquisition Lab., Fort Monmouth, N. J.
A NEW TECHNIQUE FOR DOPPLER FREQUENCY ANALYSIS OF RADAR SIGNALS
Otto E. Rittenbach Jun. 1980 14 p refs
(AD-A090435) Avail: NTIS HC A02/MF A01 CSCL 17/9

A longstanding performance goal for Army ground surveillance radars is the automatic classification of moving ground targets on the battlefield. Limited classification has been achieved by splitting the radar Doppler spectrum into lower and higher frequency bands, thus distinguishing between targets having different radial velocities. While this is an important feature, since *only certain targets (vehicles) are capable of obtaining high radial* speeds, it does not provide a distinction between a moving man and vehicles having low radial speed components. That there *are distinct differences in the Doppler signatures between man* and vehicle is easily established by listening to typical Doppler return signals. One can clearly distinguish the step modulation *of a walking man from the relatively constant or slowly changing* tone of a vehicle. As to be expected, a spectrogram of a walking man shows this repetitive behavior. Most obvious is a sinewave like frequency modulation at the step frequency of the main body return power appearing as a black band near 100 Hertz. This oscillatory temporal characteristic in the Doppler shifted frequency is practically never seen in vehicular return and is the discriminant chosen for automatic classification. GRA

N81-12315# Army Communications Research and Development Command, Fort Monmouth, N. J.
CODING AND PROCESSING FOR RELIABLE DATA TRANSMISSION
William A. Huber Jun. 1980 15 p refs
(AD-A090406) Avail: NTIS HC A02/MF A01 CSCL 09/2

The coding and processing techniques discussed in this paper *are designed to improve the reliability of digital message reception* in the presence of noise. High noise conditions occur quite frequently during radio reception especially when these signals *originate at forward area military positions. The usual cause for* this poor radio reception is related to the constraints imposed by low transmitter power, limits on air time, and unfavorable *terrain conditions. The importance of improving the reliability of* forward area message reception is stressed because the *information so obtained provides essential descriptors that are* pertinent to command and control functions. In an effort to determine the cause of message delivery failure in the presence *of increasing noise, laboratory tests were performed under* controlled noise conditions. The results of these tests indicated that as the signal-to-noise power ratio decreased errors first *appeared in the data character framing information. It should be* noted that the message synchronizing procedure used to decode received digital data is hierarchical in nature involving bit *synchronization, data character framing, and message block* identification. If any one of these functions is not correctly *implemented the transmitted message cannot be successfully decoded. Ideally, as increased noise degrades the data communica-*tions channel the synchronizing system should not fail before the message information becomes unintelligible; a condition that is presently not satisfied because data character framing requires error free code reception. GRA

N81-12316# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
A PHENOMENOLOGICAL METHOD OF CALCULATING MICROWAVE LONGITUDINAL COUPLING IMPEDANCES
S. Giordano and J. Votruba May 1980 9 p
(BNL-51222) Avail: NTIS HC A02/MF A01

A method was developed for calculating these impedances by using the data derived from perturbation measurements. This method gave accurate results between 2.6 and 2.8 GHz, but above 2.8 GHz measurements became difficult because of the *mixing of the TM sub olm modes with other modes.* A phenomenological approach for calculating these impedances based on previously developed concepts is presented. Author

N81-12317# Sheffield Univ. (England). Dept. of Electronic and Electrical Engineering.
RESEARCH IN PROGRESS: ANTENNAS, PROPAGATION AND DIGITAL IMAGE PROCESSING GROUP (APDIP)
Progress Report, 1979
1980 75 p refs
(Contract SRC-GR/A/38847)
Avail: NTIS HC A04/MF A01

Research topics include the generation of suitable illumination functions to be used in array design and superdirective image enhancement, the realization of array radiation patterns with low sidelobe levels, and the application of superresolution

techniques to time-domain reflectometry systems. Also discussed are digital processing techniques for suppressing interfering outputs in the image from in-line holograms, the near field/far field transformation based on the plane wave synthesis technique, a synthetic aperture sonar imaging system for underwater mapping, and the focusing of microwave array system for hyperthermia. Author (ESA)

N81-12318# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
NUMERICAL RESOLUTION OF DIFFUSION AND PROPAGATION PROBLEMS IN THE PARABOLIC APPROXIMATION CONTEXT
Sebastien Candel 1978 111 p refs In FRENCH; ENGLISH summary
(ONERA-P-1978-5; ISSN-0078-379X) *Avail: NTIS* HC A06/MF A01

The pressure field parabolic approximation model application to the cases of single mode homogeneous duct propagation, their radiation of and opening to free space, and the Gaussian beam propagation in an open and homogenous media, are analyzed. The parabolic equation is modified for describing single mode propagation, for analyzing the propagation of oblique waves, and for a more precise description of the propagation in a media in which the wave speed varies simultaneously in the axial and transversal directions. The numerical method utilized for the solution of the parabolic equation is described. The relationships between the Fresnel approximation and the parabolic approximation are discussed. Author (ESA)

N81-12319# Royal Signals and Radar Establishment, Malvern (England).
DEVELOPMENTS IN UNITED KINGDOM WAVEGUIDE POWER STANDARDS
P. J. Skilton London Apr. 1980 48 p refs
(RSRE-80006; BR75034) Avail: NTIS HC A03/MF A01

The United Kingdom national standards for power in waveguide consist of bolometer mounts of known efficiency at discrete frequencies from 8.2 GHz to 35 GHz. Recent developments in the design, construction, calibration and use of the standards are outlined. An analysis of random and systematic uncertainties in the microcalorimeter method of calibration is included and yields an overall uncertainty of plus or minus 0.1 percent in the mount efficiency with 95 percent confidence. Features of a technique for calibrating power meters in terms of a bolometer standard using a waveguide transfer instrument are described together with an analysis of uncertainty in the technique. Author (ESA)

N81-12320# Royal Aircraft Establishment, Farnborough (England).
THE INTELLIGIBILITY OF SPEECH PRESENTED OVER THE TELEPHONES OF THE Mk 4 FLYING HELMET
M. K. Cogger London HMSO Mar. 1980 21 p refs
(RAE-TM-FS-313; BR73977) *Avail: NTIS HC A02/MF A01*

The intelligibility of speech presented over the earphones of the Mk 4 flying helmet was assessed using the procedure laid down in the Type Test Schedule. Results obtained using three phonetically balanced word lists presented to six subjects on two occasions indicate that speech intelligibility reaches 80 percent, the criterion of acceptability laid down in the schedule. Frequency response curves for the transducer earniece assemblies of the helmet are given. The total harmonic distortion of the equipment used to present the spoken word lists is shown. Author (ESA)

N81-12321# National Technical Information Service, Springfield, Va.
LIGHT COMMUNICATIONS SYSTEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1976 - Dec. 1978
William E. Reed Oct. 1979 260 p
(PB80-815301) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The design, performance, and application of laser, infrared, and visual communication systems are covered. Transmission and equipment studies for space, atmospheric, and underwater light communication are presented. Topics covered include lasers, fiber optics, signal processing, transmission links, and data transmission. GRA

N81-12322# National Technical Information Service, Springfield, Va.
ANTENNA SIDELOBE AND INTERFERENCE REDUCTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1980
William E. Reed Aug. 1980 188 p Supersedes NTIS/PS-79/1013; NTIS/PS-78/0983
(PB80-815186; NTIS/PS-79/1013; NTIS/PS-78/0983) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites research covering techniques for sidelobe cancellation and interference rejection. Techniques include signal processing, beam forming, null steering, adaptive systems, phase shifters, element spacing, filters, and electromagnetic absorbing materials. This updated bibliography contains 183 citations, 20 of which are new entries to the previous edition. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also 60 *Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-12323*# RCA Advanced Technology Labs., Camden, N. J. Advanced Technology Labs.
HIGH SPEED CMOS/SOS STANDARD CELL NOTEBOOK
Sep. 1978 53 p
(Contract NAS8-31325)
(NASA-CR-150783) *Avail: NTIS HC A04/MF A01* CSCL 09C

The NASA/MSFC high speed CMOS/SOS standard cell family, designed to be compatible with the PR2D (Place, Route in 2-Dimensions) automatic layout program, is described. Standard cell data sheets show the logic diagram, the schematic, the truth table, and propagation delays for each logic cell. A.R.H.

N81-12324*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Design Techniques Branch.
THE MSFC SILICON GATE SILICON-ON-SAPPHIRE STANDARD CELL LIBRARY
Sep. 1978 28 p
(NASA-TM-78194) Avail: NTIS HC A03/MF A01 CSCL 09C

A pictorial representation of the MSFC silicon-on-sapphire standard cell library is presented. The cells are intended to be used with the PR2D (Place, Route in 2 Dimensions) automatic layout computer program. A.R.H.

N81-12325*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Electronics and Control Lab.
USER'S MANUAL FOR LARGE-SCALE INTEGRATED CIRCUIT LAYOUT CHECK PROGRAM
Sep. 1978 10 p refs
(NASA-TM-78192) Avail: NTIS HC A02/MF A01 CSCL 09C

A computer program is described that checks for the correctness of chip design layout generated by the Banning Placement Routing Folding program (PRF) by verifying agreement between a specified circuit design and a corresponding computer generated circuit layout as stored on the Artwork (PRF output) tape. An example computer run is included. A.R.H.

N81-12326*# Auburn Univ., Ala. Dept. of Electrical Engineering.
PLACEMENT TECHNIQUES FOR THE STANDARD TRANSISTOR ARRAY (STAR)
G. W. Cox and B. D. Carroll 11 Sep. 1978 104 p refs

(Contract NAS8-31572)
(NASA-CR-150901) Avail: NTIS HC A06/MF A01 CSCL 09C

Techniques for the placement of digital logic cells on STAR's (Standard Transistor Arrays) were developed. These techniques are designed to provide placement automation capabilities to low volume users with limited available processing power. A series of programs implementing the placement techniques was written and a number of test cases executed. Results of these test cases indicate that the methods achieve near optimum placements with respect to network routability.
Author

N81-12327*# Mississippi State Univ., Mississippi State. Microelectronics Research Lab.
A STUDY OF TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Quarterly Progress Report, 11 Jun. - 10 Sep. 1978
J. D. Trotter, T. E. Wade, and J. D. Gassaway Sep. 1978 38 p refs
(Contract NAS8-26749)
(NASA-CR-161277; MSU-EE-QUAR-4-78) Avail: NTIS HC A03/MF A01 CSCL 09C

Furnaces and photolithography related equipment were applied to experiments on double layer metal. The double layer metal activity emphasized wet chemistry techniques. By incorporating the following techniques: (1) ultrasonic etching of the vias; (2) premetal clean using a modified buffered hydrogen fluoride; (3) phosphorus doped vapor; and (4) extended sintering, yields of 98 percent were obtained using the standard test pattern. The two dimensional modeling problems have stemmed from, alternately, instability and too much computation time to achieve convergence.
S.F.

N81-12328*# RCA Advanced Technology Labs., Camden, N. J. Defense Electronic Products.
C-MOS ARRAY DESIGN TECHNIQUES
A. Feller Aug. 1978 67 p
(Contract NAS12-2233)
(NASA-CR-150799) Avail: NTIS HC A04/MF A01 CSCL 09C

The entire complement of standard cells and components, except for the set-reset flip-flop, was completed. Two levels of checking were performed on each device. Logic cells and topological layout are described. All the related computer programs were coded and one level of debugging was completed. The logic for the test chip was modified and updated. This test chip served as the first test vehicle to exercise the standard cell complementary MOS(C-MOS) automatic artwork generation capability.
A.R.H.

N81-12329*# Mississippi State Univ., Mississippi State.
TRENDS AND TECHNIQUES FOR SPACE BASE ELECTRONICS Quarterly Report
J. D. Gassaway, Q. Mahmood, and J. D. Trotter 12 Jun. 1978 165 p refs
(Contract NAS8-26749)
(NASA-CR-150825) Avail: NTIS HC A08/MF A01 CSCL 09C

A system was developed for depositing aluminum and aluminum alloys by the D.C. sputtering technique. This system which was designed for a high level of cleanliness and ion monitoring the deposition parameters during film preparation is ready for studying the deposition and annealing parameters upon double level metal preparation. The finite element method was studied for use in the computer modeling of two dimensional MOS transistor structures. An algorithm was developed for implementing a computer study which is based upon the finite difference method. The program was modified and used to calculate redistribution data for boron and phosphorous which had been predeposited by ion implantation with range and straggle conditions typical of those used at MSFC. Data were generated for < 111 > oriented SOS films with redistribution in N2, dry O2 and steam ambients. Data are given showing both two dimensional effects and the evolution of the junction depth, sheet resistance and integrated dose with redistribution time.
J.M.S.

N81-12330*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THREE PHASE POWER FACTOR CONTROLLER Patent Application
Frank J. Nola, inventor (to NASA) Filed 23 Oct. 1980 17 p
(NASA-Case-MFS-25535-1; US-Patent-Appl-SN-199765) Avail: NTIS HC A02/MF A01 CSCL 09C

A power control circuit for a three phase induction motor is described. The power factors for the three phases are summed to provide a control signal. This control signal is particularly filtered and then employed to control the duty cycle of each phase of input power to the motor.
NASA

N81-12331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NON-CONTACTING POWER TRANSFER DEVICE Patent Application
John Paulkovich and Philip A. Studer, inventors (to NASA) Filed 13 Nov. 1980 14 p
(NASA-CASE-GSC-12595-1; US-Patent-Appl-SN-206506) Avail: NTIS HC A02/MF A01 CSCL 09C

A transformer for coupling AC electrical energy from a stationary element to a rotating element without the use of sliding contacts is described. The transformer is of the rotary type and includes a ferrite core and two primary windings which are stationary with respect to a secondary winding which rotates within an annular cavity adjacent to an axial bore in the core. The core is comprised of two cup type core halves. Electrical connection to the secondary winding is made through a split bobbin assembly which couples to a coaxial shaft assembly located in the axial bore. The electrical coupling to the coaxial shaft assembly is made through a continuous transverse channel connecting the axial bore with the annular cavity.
NASA

N81-12332# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
COMBAT HARDENED COMMUNICATIONS: HIGH PRECISION FREQUENCY CONTROL USING RESONATORS IMMUNE TO ACCELERATION AND STRESS FIELDS
Arthur T. Ballato and Theodore Lukazek Jun. 1980 15 p refs
(AD-A090361) Avail: NTIS HC A02/MF A01 CSCL 09/1

This paper describes quartz resonators that provide simultaneous compensation against both dynamic and static conditions, and that are compensated, moreover, against rapid temperature transients encountered in fast-warmup oscillators for manpac use.
GRA

N81-12333# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SEMI-INSULATING GALLIUM ARSENIDE FOR MILLIMETER WAVE AND HIGH SPEED IC DEVICE APPLICATIONS
Raymond L. Ross, Thomas R. Aucoin, Robert O. Savage, John J. Winter, and Roger J. Malik Jun. 1980 14 p refs
(AD-A090437) Avail: NTIS HC A02/MF A01 CSCL 09/1

A wide variety of semiconductor devices utilizing gallium, Arsenide (GaAs) is currently under development by the military for use in advanced communication, surveillance, and target acquisition systems. The low-field electron mobility of GaAs is one of its greatest attributes and offers high frequency operation in devices such as the field effect transistor (FET). Coupled with the material's high peak velocity and low threshold field, GaAs integrated circuit (IC) devices offer a two to six time speed improvement over their silicon counterparts. When compared with standard silicon IC technology, the process steps for GaAs ICs are relatively simple and few in number. As a result of these advantages, the technology of manufacturing high performance GaAs devices is maturing at a rapid rate.
GRA

N81-12334# Stanford Univ., Calif. Dept. of Computer Science.
THE COMPILATION OF REGULAR EXPRESSIONS INTO INTEGRATED CIRCUITS
Robert W. Floyd and Jeffrey D. Ullman Apr. 1980 31 p refs
(Contract MDA903-80-C-0102; NSF MCS-79-04528)
(AD-A090507; SU-STAN-CS-80-798) Avail: NTIS HC A03/MF A01 CSCL 09/5

We consider the design of integrated circuits to implement arbitrary regular expressions. In general, we may use the

McNaughton-Yamada algorithm to convert a regular expression of length n into a nondeterministic finite automation with at most 2n states and 4n transitions. Instead of converting the nondeterministic device to a deterministic one, we propose two ways of implementing the nondeterministic device directly. First, we could produce a PLA (programmable logic array) of approximate dimensions 4n x 4n by representing the states directly by columns, rather than coding the states in binary. This approach, while theoretically suboptimal, makes use of carefully developed technology and, because of the care with which PLA implementation has been done, may be the preferred technique in many real situations. Another approach is to use the hierarchical structure of the automation produced from the regular expression to guide a hierarchical layout of the circuit. This method produces a circuit O(square root of n) on a side and is, to within a constant factor, the best that can be done in general. GRA

N81-12335# Harry Diamond Labs., Adelphi, Md.
GIGAWATT MICROWAVE EMISSION FROM A RELATIVISTIC REFLEX TRIODE
Howard E. Brandt, Alan Bromborsky, Henry B. Bruns, Richard A. Kehs, and George P. Lasche Aug. 1980 26 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A090598; HDL-TR-1917) Avail: NTIS HC A03/MF A01 CSCL 09/1

Single microwave bursts in X-band of 10-ns duration at gigawatt power levels have been obtained with the relativistic reflex triode. The associated relativistic space-charge oscillations have rich high-frequency content. The dominant radiated modes are determined by gap spacing, beam diameter, and gap voltage. The theory of the collective electron space-charge oscillations and the resultant microwave power spectrum is reviewed and compared with experiment. GRA

N81-12336# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
FUNDAMENTAL LIMITATIONS OF ELECTRON BEAM LITHOGRAPHY FOR FUTURE MILITARY IC FABRICATION
G. J. Lafrate, J. N. Helbert, Arthur T. Ballato, C. F. Cook, Jr., and W. S. McAfee Jun. 1980 14 p refs
(AD-A090407) Avail: NTIS HC A02/MF A01 CSCL 09/5

Future military requirements for real-time information acquisition and tactical electronic warfare (EW) information processing have established a need for very large scale (VLSI) and very high speed (VHSI) integrated circuit microelectronics. Both VLSI and VHSI technologies require a high areal density of integrated circuit (IC) elements thereby dictating a reduction of device size into the submicron and ultra-submicron regions. The requisite miniaturization of military IC devices into the submicron and ultra-submicron region serious questions regarding the use of electron beam lithography (EBL) as an appropriate fabrication technique for this end. In EBL an intermediate energy (5-20 keV) electron beam exposes a radiation sensitive target (such as the polymer PMMA) overlaid on an IC device substrate; a subsequent chemical development treatment removes the exposed region leaving an outline of the pattern sketched by the electron beam (e-beam) when employing a positive-acting resist. GRA

N81-12337# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
MILLIMETER-WAVE SELF MIXING OSCILLATORS
Samuel Dixon and Harold Jacobs Jun. 1980 13 p refs
(AD-A090384) Avail: NTIS HC A02/MF A01 CSCL 09/4

A metal waveguide self-mixing oscillator utilizing a coaxial waveguide hybrid circuit was designed, with emphasis on low weight, low cost, and simple construction. Dielectric waveguide technology was applied using a Gunn diode, in a simply constructed cavity, in a self-excited oscillator-mixer mode of operation. Both GaAs and InP Gunn diodes were imbedded in an aperture which was cut in a high resistivity aluminum oxide dielectric waveguide. The significance of the dielectric waveguide technology is that active devices, as well as passive components, can be developed and integrated into circuit modules to construct functional subsystems. Experimental data indicate that the sensitivity of these devices is on the order of -80 dBm which would make them competitive with other conventional mixers. However, these devices have the advantage of having simplified construction with a high signal power burnout level coupled with very low unit cost. These characteristics make the self-mixing oscillator a viable device in low cost receivers, expendable EW sensors, and short range terminal guidance. J.M.S.

N81-12338# Harris Corp., Melbourne, Fla. Government Information Systems Div.
MICROWAVE INTEGRATED CIRCUITS PROCEDURES EVALUATION Final Technical Report
M. F. Belgin, B. C. Mitchell, and V. R. Beahy Jun. 1980 210 p refs
(Contract F30602-78-C-0335; AF Proj. 2338)
(AD-A090677; RADC-TR-80-201) Avail: NTIS HC A09/MF A01 CSCL 09/5

Microwave Integrated Circuits and Stripline Microwave Circuits are used widely in military ground, airborne, and spaceborne systems. The current military specifications which are invoked generally for hybrid circuits (MIL-STD-883B and MIL-M-38510) require either up-dating to encompass these two classes of microcircuits or new test methods need to be developed. New test methods have been developed for the screening, quality, and lot conformance testing of Microwave Integrated Circuits and Stripline Microwave Circuits. Pre-seal visual criteria for Stripline Microwave Circuits was also developed as well as an up-date to Method 2017, MIL-STD-883B for Microwave Integrated Circuits. Computer analysis of the various construction methods utilized by the industry was performance as a first step evaluation of the construction methods and the proposed criteria. GRA

N81-12339# Hughes Research Labs., Malibu, Calif.
PULSE POWER SWITCH DEVELOPMENT Final Report, 19 Sep. 1979 - 18 Jan. 1980
R. Harvey, H. Gallagher, and S. Hansen Jan. 1980 62 p refs
(Contract N60921-79-C-0276; Arpa Order 3718)
(AD-A090511) Avail: NTIS HC A04/MF A01 CSCL 09/1

The objective of this study program has been to define an optimum technical approach to the longer range goal of achieving practical high repetition rate high power spark gap switches. Requirements and possible means of extending the state of the art of crossed field closing switches, vacuum spark gaps, and pressurized spark gaps are presented with emphasis on reliable, efficient and compact devices operable in burst mode at 250-300 kV, 40-60 kA, = 1 kHz with approximately 50 nsec pulses rising in approximately 3 ns. Models of these devices are discussed which are based upon published and generated design data and on underlying physical principles. Based upon its relative advantages, limitations and tradeoffs we conclude that the Hughes Crossatron switch is the nearest term approach to reach the switch goal levels. Theoretical, experimental, and computer simulation models of the plasma show a collective ion acceleration mechanism to be active which is predicted to result in current rise times approaching 10 nsec. A preliminary design concept is presented. For faster rise times we have shown a vacuum surface flashover switch to be an interesting candidate. This device is limited by trigger instabilities and will require further basic development. The problem areas relevant to high pressure spark gaps are reviewed. GRA

N81-12340# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
LARGE SIGNAL TWT COMPUTER THEORY Final Technical Report, Dec. 1978 - Apr. 1980
Tore Wessel-Berg Aug. 1980 86 p
(Contract F30602-79-C-0028; AF Proj. 4506)
(AD-A090748; EDD-W-08146; RADC-TR-80-262) Avail: NTIS HC A05MF A01 CSCL 09/1

The implementation of variable circuit parameters along the axis involves the handling of velocity tapers, impedance tapers, and variable attenuator sections, all in any prescribed fashion. The second area is concerned with analysis of backward wave instabilities under the same conditions of variable parameters along the tube. In particular, the theory is applicable for segmented TWTs, i.e., tubes with several sections of otherwise constant circuit parameters. Such configurations are known to reduce backward wave instabilities, but the underlying theoretical background and the modeling have been inadequate. In particular, the symmetries and coupling relations of beam and circuit modes

have not been sufficiently well understood. The present work is an effort to contribute to a better understanding of these effects and provide improved models and mathematical procedures for use in numerical analysis of backward wave instabilities. One part of the investigation is the analysis of the properties of the beam modes involved in backward wave interactions. These have different symmetries from the usual circularly symmetric modes involved in forward interaction, and need special consideration. GRA

N81-12341# Bendix Corp., Kansas City, Mo.
MULTILAYER PRINTED WIRING BOARD LAMINATION Final Report
J. W. Lula Jun. 1980 25 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2422) Avail: NTIS HC A02/MF A01

The relationship of delamination resistance of multilayer printed wiring boards made from general purpose fire retardant epoxy/glass material to manufacturing process variables was investigated. A quantitative test method developed during this project shows that delamination resistance is highly sensitive to material conditioning, to innerlayer surface treatment, and to post lamination storage conditions, but is relatively insensitive to cure cycle variations. E.D.K.

N81-12342# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
A15 MULTIFILAMENTARY SUPERCONDUCTORS BY THE INFILTRATION PROCESS
M. R. Pickus and J. T. Holthuis May 1980 27 p refs Presented at Intern. Cryog. Mater. Conf., Upton, N.Y., 28 May 1980
(Contract W-7405-eng-48)
(LBL-10761; CONF-800587-5) Avail: NTIS HC A03/MF A01

The development of A15 compounds for superconducting tapes and wires is discussed. The quench age technique, a nonpowder process, was employed for the niobium aluminum system, following the special features of the equilibrium phase diagram. The powder approach proved particularly effective for binaries, such as Nb-Sn, and for the ternaries Nb(Al,Ge) and Nb(Al,Si). Two variations of the powder process were assessed. One involved the use of precompounded powder of the desired stoichiometry but required simultaneous application of heat and pressure. The second variation was the infiltration process. This process involves the preparation of a ductile niobium matrix containing a controlled network of interconnected pores which are subsequently infiltrated with liquid metals (Sn) or low melting point eutectics (e.g., Al-Ge, Al-Si). The composite is then subjected to a thermomechanical treatment to form a multiply connected array of A15 filaments in a niobium matrix. DOE

N81-12343# Martin Marietta Aerospace, Orlando, Fla.
SWIFT
Winthrop Smith 26 Jun. 1980 9 p refs
(AD-A090647) Avail: NTIS HC A02/MF A01 CSCL 09/3

The SWIFT algorithm is a new way of computing the discrete Fourier transform (DFT) that can be efficiently implemented in hardware for any range of data rate requirements. It is based on a new decomposition of the discrete Fourier transform and a novel set of implementations of the decomposed equations that leads to hardware that is twice as fast and one-third the size of existing fast Fourier transform (FFT) implementations. Additionally, the algorithm can be applied to any length DFT. This removes the inefficiencies produced by the power of two restriction of the FET. GRA

N81-12344# Bendix Corp., Kansas City, Mo.
COMPARISON OF METALLIZATION SYSTEMS FOR THIN FILM HYBRID MICROCIRCUITS
R. A. Hines and M. K. Raut Aug. 1980 41 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2489) Avail: NTIS HC A03/MF A01

Five metallization systems for thin film hybrid microcircuits are evaluated for their thermocompression bondability, corrosion resistance, and solderability. The chromium/palladium/gold system and the titanium/palladium/gold system with either electroplated or evaporated gold are compared to the evaporated chromium/gold system. Peel strengths and failure modes were measured on over 7000 leads to evaluate the bondability and adhesion of each system and of several substrates tested on each system. The Ti/Pd/electroplated Au metallization system produced the most desirable results. The solder filled electroplated gold vias do not degrade significantly with temperature cycling. Soldered components pulled from both electroplated and evaporated gold failed at similar values. In each evaluation, the Ti/Pd/electroplated Au system proved equal or superior to the other systems. M.G.

N81-12345# Bendix Corp., Kansas City, Mo.
HYBRID MICROCIRCUIT VIA DEVELOPMENT Final Report
D. A. Norwood Jun. 1980 24 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2395) Avail: NTIS HC A02/MF A01

Hybrid microcircuits were designed to interconnect frontside thin-film networks with metallized backside ground planes on 95 by 114 mm square alumina substrates. Manufacturing processes were developed for making holes in alumina substrates, metallizing substrates on both sides and through vias, dry film photolithographing 6 micrometers thick gold to 127 micrometers line widths and spacings, and determining via quality and acceptance. The techniques developed produce vias which exhibit through-hole resistances of less than 10 microhms and are acceptable for radio frequency or logic circuit application. Sample parts were fabricated and evaluated on both test substrates and production substrates to prove in the new techniques. The few problems encountered with initiating a new process into production were solved, and via related technology were used successfully in production. L.F.M.

N81-12346# Siemens A.G., Munich (West Germany). Forschungslab.
LARGE SCALE INTEGRATED MOS CIRCUITS WITH SMALL DIMENSIONS. PREPARATION OF THIN FILMS Final Report, Aug. 1977
Dietrich Widmann Bonn Bundesministerium fuer Forschung und Technol. Nov. 1979 48 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-55; ISSN-0340-7608) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 9,65

Results obtained by step-and-repeat projection printing are reported, emphasizing resolution capability, overlay precision, and defect density. Several functioning integrated circuits with minimum dimensions of 1.5 microns were manufactured using the step-and-repeat projection printing technique discussed. Additionally, a process for the evaporation aluminum/copper/silicon films and a process for bias sputtering of silicon dioxide films are described. Both processes are shown applicable to complex integrated circuits with small dimensions.Author (ESA)

N81-12347# Siemens A.G., Munich (West Germany). Geschaeftsbereich Datenverarbeitung.
CIRCUIT DESIGN TECHNIQUES FOR MOS MEMORIES Final Report
Hans-Joachim Harloff Bonn Bundesministerium fuer Forschung und Technol. Dec. 1979 21 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technol.
(BMFT-FB-DV-79-07; ISSN-0170-9011) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 4,20

Using computer aided circuit design methods with modern semiconductor technology, dynamic MOS memory chips with a capacity of 65,536 bits were developed. These state of the art memory chips for computer systems are shown to be compatible with those available from other manufacturers. In addition to circuit design, procedures are described. A series of 5 devices with capactities ranging from 256 to 65,536 bits was realized. Three of these devices have entered the production phase. The development of a device containing 262,144 bits is examined. Author (ESA)

N81-12348# Siemens A.G., Munich (West Germany). Unternehmensbereich Daten- und Informationssysteme.
FAULT DIAGNOSIS SYSTEM FOR COMPLEX LOGIC BOARD

Final Report
Ferdinand Kreisl, Udo Lemke, Gerhard Pflug, Wolfgang Seefeldner, Rolf Tannhaeuser, and Gerd Ihlefeldt Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 170 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technol.
(BMFT-FB-DV-79-10; ISSN-0170-9011) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 35,70

A modular fault diagnosis system for testing and fault localization on complex logic boards was developed. Modules with up to 560 logic pins based on data processing packaging technologies using ECL, TTL, or MOS circuits, as well as mixed configurations can be fully tested automatically. Fault diagnosis is accomplished with an automatic board tester in accordance with the fault path tracing method. An automatic tester operating system controls the rapid transfer of large data volumes at a high data rate. For writing test specimen programs, a problem oriented high level test language with an associated compiler is used. Author (ESA)

N81-12349# Electricity Council Research Centre, Capenhurst (England).
A PRELIMINARY INVESTIGATION OF THE BEHAVIOR OF TITANIUM-LEAD DIOXIDE ELECTRODES
G. H. Kelsall and R. Stevens Jun. 1979 76 p refs
(ECRC/M1266) Avail: NTIS HC A05/MF A01

An identification is made of the relative importance on the behavior of Ti/PbO2 in chloride solutions of such factors as: surface roughness/active surface ratio; alpha PbO2/beta PbO2 ratios; time/history; deposition morphology and defect structure; initial relative growth rates of TiOx and PbO2. It is shown that the performance of the anodes show no definite dependencies on the various plating/preparation conditions examined. Author (ESA)

N81-12350# Societe Crouzet, Valence (France). Div. Aerospatiale et Systemes.
DEVELOPPEMENT OF HYBRID CIRCUITS, A SUMMARY [DEVELOPPEMENT DE CIRCUITS HYBRIDES. RAPPORT DE SYNTHESE]
Duban and Chesne Paris ESA 6 Jun. 1979 51 p In FRENCH Revised Original contains color illustrations
(Contract ESA-2839/76-HP)
(ESA-CR(P)-1243-Rev-B) Avail: NTIS HC A04/MF A01

The main development phases of five hybrid thick film circuits are described. These circuits are to be used in an on-board data handling system. The essential characteristics of each circuit and the references to the documents containing the complete results are included. Author (ESA)

N81-12351# Atomic Weapons Research Establishment, Aldermaston (England).
MODELING OF COMPRESSED MAGNETIC FIELD GENERATORS BY EQUIVALENT CIRCUIT APPROACH
M. Jones London Jul. 1980 53 p refs
(AWRE-O-21/80; BR75017; ISBN-0-8551841-9) Avail: NTIS HC A04/MF A01; HMSO £1,50 PHI

An equivalent circuit model is presented for a helical compressed magnetic field generator. The model is designed for short computer run times. A magnetic field can be amplified by driving current carrying conductors at high velocities by means of explosives. The model of this one-shot generator takes the form of an L-R lumped equivalent electrical circuit. Magnetic energy losses due to nonlinear field diffusion are taken into account, together with the effects of magnetically induced conductor motion. It is shown that ten complete runs on an IBM 370/168 computer take about one minute, and that predicted values are in good agreement with experimental data.
Author (ESA)

N81-12352# European Space Agency, Paris (France).
INVESTIGATION INTO THE SENSITIVE PARAMETERS IN A QUARTZ OSCILLATOR Ph.D Thesis - Pierre and Marie Curie Univ.
Francois Tardivel Nov. 1980 188 p refs Transl. into ENGLISH of 'Rech. des Parametres Sensibles d'un Oscillateur a Quartz', Rept. ONERA-NT-1979-10 Onera, Paris, 1979 Original report in FRENCH previously announced as N80-23588
(ESA-TT-636; ONERA-NT-1979-10) Avail: NTIS HC A09/MF A01

A quartz operational cascade type oscillator is considered. A diode limiter device and a feedback loop using a band filter that selects the desired quartz overtone are included. A computing method is described which allows the elaboration of a mathematical model simulating the working of the oscillator. The model accounts for a number of nonlinearities introduced by the transistors, the diodes, and the quartz resonator. This model permits the determination of the sensitivity to a score of parameters of the frequency of the oscillator and proves the important part played by the band filter of the feedback loop, the electric coupling of the filter, and the diode limiter device in the instability of the oscillator frequency. In order to minimize the contribution of electronics in this instability at medium and long term, a modification of the structure of the feedback loop is proposed. Author (ESA)

N81-12353# Royal Signals and Radar Establishment, Malvern (England).
A COMPARISON BETWEEN ELECTRIC FIELD STRENGTHS SIMILARLY GENERATED AND MEASURED IN THE OPEN AIR, IN A SHIELDED ENCLOSURE AND IN A LARGE AIRCRAFT HANGAR, OVER FREQUENCY RANGE 10 TO 110 MHz
M. Dew and F. Harrison London Feb. 1980 18 p refs
(RSRE-MEMO-3248; BR73471) Avail: NTIS HC A02/MF A01

Field strength measurements over 10 to 110 MHz were made using a tracking generator counter, a spectrum analyzer, and a biconal antenna. The dimensions of the shielded enclosure were 6.1 x 3.66 x 3.0 m, and the concrete floored, metal hangar 80 x 40 x 10 m. It was found that in each polarization the hangar performance deviated much less from that in the open air than did the shielded enclosure performance. The latter shows deviations with modulus as great as 38 dB (certical pol) and 26 dB (horizontal pol). For any electric field strength measured in the shielded enclosure (in 10 kHz bandwidth in the range 10 to 110 MHz) the probability that the result would be at least 6 dB different from that similary obtained in the open air was 38% or 43.5% according to polarization and that when similarly measured in the hangar the corresponding probabilities were 0% and 1%. Hangar results were shown to lie much closer to the open air results than do the shielded enclosure results. This is further demonstrated by the rms deviations of the shielded enclosure and hangar readings from those of the open air.
Author (ESA)

N81-12354# National Technical Information Service, Springfield, Va.
ELECTRICAL FAULT LOCATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1980
William E. Reed Aug. 1980 319 p Supersedes NTIS/PS-79/0892; NTIS/PS-78/0805
(PB80-813652; NTIS/PS-79/0892; NTIS/PS-78/0805) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

Reports covering the location of electrical faults in circuits and components, electric power transmission and distribution systems, and electrical and electronic equipment for radar, radio, television, telephone, and computers are cited. Test equipment for electrical fault location is also discussed. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N81-12355 Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
SHEARED ZONE CONSIDERATIONS IN INCOMPRESSIBLE

TURBULENT BOUNDARY LAYER CALCULATIONS [PRISE EN COMPTE D'UNE ZONE DECOLLEE DANS LE CALCUL D'UNE COUCHE LIMITE TURBULENTE INCOMPRESSIBLE]

B. Gay and G. M. Assassa (Ecole Centrale de Lyon) Paris Association Aeronautique et Astronautique de France 1980 92 p refs In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979

(AAAF-NT-80-03; ISBN-2-7170-0599-4) Avail: NTIS HC A05; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

The numerical treatment of the boundary layer equation and its optimization were studied. The onset of shearing always appears as a singularity in the boundary layer equations. It is for this reason that some results on the behavior of solutions near the separation point are given for the laminar case and with the Falkner-Skan model. The behavior of slightly sheared zones was also studied. Optimum control methodology is described.

Author (ESA)

N81-12356*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

AN IMPROVED VISCOUS CHARACTERISTICS ANALYSIS PROGRAM

Renaldo V. Jenkins Nov. 1978 158 p refs

(NASA-TP-1289; L-12320) Avail: NTIS HC A08/MF A01 CSCL 20D

An improved two dimensional characteristics analysis program is presented. The program is built upon the foundation of a FORTRAN program entitled Analysis of Supersonic Combustion Flow Fields With Embedded Subsonic Regions. The major improvements are described and a listing of the new program is provided. The subroutines and their functions are given as well as the input required for the program. Several applications of the program to real problems are qualitatively described. Three runs obtained in the investigation of a real problem are presented to provide insight for the input and output of the program. S.F.

N81-12357*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ROTATING LIQUID DROPS: PLATEAUS EXPERIMENT REVISITED

R. Tagg, L. Cammack, A. Croonquist, and T. G. Wang 15 Oct. 1980 71 p refs

(Contract NAS7-100)

(NASA-CR-163745; JPL-Pub-80-66) Avail: NTIS HC A04/MF A01 CSCL 20D

The dynamics of liquid drops rotating in another liquid were studied experimentally with an oil drop suspended in a neutral buoyancy tank. New stable shapes not predicted by the theory were observed. Author

N81-12358*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TURBULENT SOLUTION OF THE NAVIER-STOKES EQUATIONS

R. G. Deissler 1980 23 p refs Presented at Thirty-Third Ann. Meeting of the Div. of Fluid Dyn. of the Am. Phys. Soc., Ithaca, N.Y., 23-25 Nov. 1980

(NASA-TM-81621; E-631) Avail: NTIS HC A02/MF A01 CSCL 20D

The unaveraged Navier-Stokes equations are solved numerically in order to study the nonlinear physics of incompressible turbulent flow. Initial three dimensional cosine velocity fluctuations and periodic boundary conditions are used. No mean gradients are present. The three components of the mean square velocity fluctuations are equal for the initial conditions chosen. The resulting solution shows characteristics of turbulence, such as the nonlinear excitation of small scale fluctuations. For the higher Reynolds numbers the initially nonrandom flow develops into an apparently random turbulence. J.M.S.

N81-12359*# National Aeronautics and Space Administration, Washington, D. C.

EXPERIMENTAL ANALYSIS OF THE BOUNDARY LAYER TRANSITION WITH ZERO AND POSITIVE PRESSURE GRADIENT

D. Arnal, J. C. Jullen, and R. Michel Feb. 1980 30 p refs Transl. into ENGLISH of "Analyse Experimentale de la transition de la Couche Limite avec Gradient de Pression Nul ou Positif" Rept. TP-1979-8, Chatillon, France, 1979 14 p Presented at the 21st Ann. Conf. on Aviation and Astronautics, Tel Aviv and Haifa, 28 Feb. - 1 Mar. 1979 Original language document announced as A79-50922 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by ONERA, Chatillon, France

(Contract NASw-3199)

(NASA-TM-75763; TP-1979-8) Avail: NTIS HC A03/MF A01 CSCL 20D

The influence of a positive pressure gradient on the boundary layer transition is studied. The mean velocity and turbulence profiles of four cases are examined. As the intensity of the pressure gradient is increased, the Reynolds number of the transition onset and the length of the transition region are reduced. The Tollmein-Schlichting waves disturb the laminar regime; the amplification of these waves is in good agreement with the stability theory. The three dimensional deformation of the waves leads finally to the appearance of turbulence. In the case of zero pressure gradient, the properties of the turbulent spots are studied by conditional sampling of the hot-wire signal; in the case of positive pressure gradient, the turbulence appears in a progressive manner and the turbulent spots are much more difficult to characterize. S.F.

N81-12360*# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.

INVESTIGATION OF BLOWN BOUNDARY LAYERS WITH AN IMPROVED WALL JET SYSTEM Final Report, 1 Jul. 1978 - 31 Dec. 1979

K. R. Saripalli and R. L. Simpson Washington NASA Nov. 1980 319 p refs

(Grant NsG-1548)

(NASA-CR-3340) Avail: NTIS HC A14/MF A01 CSCL 20D

Measurements were made in a two dimensional incompressible wall jet submerged under a thick upstream boundary layer with a zero pressure gradient and an adverse pressure gradient. The measurements included mean velocity and Reynolds stresses profiles, skin friction, and turbulence spectra. The measurements were confined to practical ratios (less than 2) of the jet velocity to the free stream velocity. The wall jet used in the experiments had an asymmetric velocity profile with a relatively higher concentration of momentum away from the wall. An asymmetric jet velocity profile has distinct advantages over a uniform jet velocity profile, especially in the control of separation. Predictions were made using Irwin's (1974) method for blown boundary layers. The predictions clearly show the difference in flow development between an asymmetric jet velocity profile and a uniform jet velocity profile. Author

N81-12361*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

IN-FLIGHT BOUNDARY-LAYER MEASUREMENTS ON A HOLLOW CYLINDER AT A MACH NUMBER OF 3.0

Robert D. Quinn and Leslie Gong Nov. 1980 52 p refs

(NASA-TP-1764; H-1101) Avail: NTIS HC A04/MF A01 CSCL 20D

Skin temperatures, shear forces, surface static pressures, boundary layer pitot pressures, and boundary layer total temperatures were measured on the external surface of a hollow cylinder that was 3.04 meters long and 0.437 meter in diameter and was mounted beneath the fuselage of the YF-12A airplane. The data were obtained at a nominal free stream Mach number of 3.0 (a local Mach number of 2.9) and at wall to recovery temperature ratios of 0.66 to 0.91. The local Reynolds number had a nominal value of 4,300,000 per meter. Heat transfer coefficients and skin friction coefficients were derived from skin temperature time histories and shear force measurements, respectively. In addition, boundary layer velocity profiles were derived from pitot pressure measurements, and a Reynolds analogy factor was obtained from the heat transfer and skin friction measurements. The measured data are compared with several boundary layer prediction methods. Author

N81-12362*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

HEAT PIPE HONEYCOMB PANEL Patent Application

Charles J. Camarda and H. Neale Kelly, inventors (to NASA)

Filed 3 Sep. 1980 12 p
(NASA-Case-LAR-12637-1; US-Patent-Appl-SN-183706) Avail: NTIS HC A02/MF A01 CSCL 20D

A thermally inert structural panel, having low thermal resistance normal to its sheets, and a high strength-to-weight ratio is described. A honeycomb lattice was sealed from the environment between upper and lower sheets, the inner surfaces which have grooves and are saturated with a working fluid. Openings which include slots and notches, may be contained within the honeycomb lattice for intercell flow of the working fluid within the panel. Heating one sheet of the panel evaporates working fluid on that plate which then condenses on other surfaces within the panel. The condensed fluid is returned to the evaporating plate by capillary flow. NASA

N81-12363*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CURVED FILM COOLING ADMISSION TUBE Patent Application
R. W. Graham and S. S. Papell, inventors (to NASA) Filed 27 Oct. 1980 12 p
(NASA-Case-LEW-13174-1; US-Patent-Appl-SN-200634) Avail: NTIS HC A02/MF A01 CSCL 20D

Effective film cooling to protect a wall surface from a hot fluid which impinges on or flows along the surface is proposed. A film of cooling fluid having increased area is provided by changing the direction of a stream of cooling fluid through an angle of from 135 degrees to 165 degrees before injecting it through the wall into a hot flowing gas at an angle to form a cooling fluid film. Cooling fluid is supplied to the orifice from a cooling fluid source via a turbulence control passageway having a curved portion between two straight portions. The angle through which the direction of the cooling fluid is turned results in less mixing of the cooling fluid with the hot gas, thereby substantially increasing the length of the film in a downstream direction. NASA

N81-12364# Air Force Geophysics Lab., Hanscom AFB, Mass.
A ONE DIMENSIONAL VERTICAL DIFFUSION PARAMETER FOR EXTREMELY INHOMOGENEOUS, LAYERED TURBULENCE IN STRATIFIED FLUIDS Interim Report
Edmond M. Dewan 16 Jun. 1980 51 p refs
(AF Proj. 6687)
(AD-A090340; AFGL-TR-80-0186; AFGL-ERP-707) Avail: NTIS HC A04/MF A01 CSCL 20/4

A self-consistent method of characterizing vertical turbulent transport by means of a diffusion parameter is demonstrated for the extremely inhomogeneous case of layered turbulence in a stratified fluid. Between the horizontal turbulent layers, horizontal laminar flow is assumed to occur, and molecular diffussion is ignored. The layers are assumed to occur at random heights with random thickness. An analogy is made between the process of random mixing layers and the finite difference representation of the diffusion equation. It is demonstrated by means of a series of digital computer experiments that, in the case where total mixing takes place within the turbulent layers, the diffusion parameter herein developed is the valid one to use (in contrast to 'eddy diffusivity'). The relation between this inhomogeneous diffusion parameter and practical experimental measurements is given. The motive behind this investigation involves vertical transport of pollution in the environment in general and in the stratosphere in particular. GRA

N81-12365# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TIME DEPENDENT NAVIER-STOKES SOLUTION OF A TURBULENT GAS JET EJECTED FROM A RECTANGULAR ORIFICE INTO A HIGH-SUBSONIC CROSS FLOW Ph.D. Thesis
William C. Golbitz Jun. 1980 189 p refs
(AF Proj. 317J)
(AD-A090343; AFIT/DS/AA/80-1) Avail: NTIS HC A09/MF A01 CSCL 20/4

High temperature exhaust gases from an airborne chemical laser ejected at a jet to freestream dynamic pressure ratio (Q) of 0.15 from an aspect ratio 1.75 rectangular diffuser exit aligned parallel to the ambient crossflow was numerically simulated. The time dependent, three-dimensional Navier-Stokes equations and a species conservation equation were solved. Diffusive flux effects caused by concentration gradients as well as variable transport and thermodynamic properties were incorporated into the numerical model. Turbulence closure was achieved by a locally varying velocity defect eddy viscosity model. Chemical reactions between the exhaust gases and the crossflow were proscribed. The trajectory of the jet plume, the extent of recirculation zones, and regions with high rates of heat transfer were defined. Simplified analyses demonstrated that essential flow phenomena were replicated. Convective processes dominated the low Q jet-crossflow interaction. Thermal diffusion had significantly greater effect than molecular diffusion for the jet-crossflow gases simulated. Jet penetration was dependent upon the molecular weight of the injectant for the constant Q constraint. A molecular weight correction factor was empirically used to synthesize the trajectory of one gas from that of another gas and to correct empirical trajectory formulae for molecular weight variances. Sensitivity analyses relating heat transfer to the injection surface from the jet plume with the magnitude of the turbulence diffusivities were conducted. GRA

N81-12366# Southern Methodist Univ., Dallas, Tex. Dept. of Civil and Mechanical Engineering.
MEASUREMENTS OF UNSTEADY TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENTS Final Report, 1 Apr. 1976 - 31 May 1979
R. L. Simpson, Y. T. Chew, and B. G. Shivaprasad Aug. 1980 59 p refs
(Grant DAAG29-76-G-0187)
(AD-A090585; WT-6; ARO-13367.4-EX) Avail: NTIS HC A04/MF A01 CSCL 20/4

Although periodic unsteady turbulent boundary layers are of real significance in turbomachines and helicopters, little experimental velocity distribution data have been obtained, especially with flow separation. An unsteady turbulent boundary layer facility was developed at SMU to produce almost-sinusoidal waveforms for practical reduced frequencies of the order of unity. Separation occurred on the flat test-wall of the diverging test section. An active boundary layer control system was developed to prevent separation on non-test walls of the test section. Detailed measurements using laser and hot-wire anemometry were made at reduced frequencies of 0.55 and 1.0. Well upstream of separation the flow away from the wall behaved in a quasi-steady manner. Near the wall an unexpected phase shift occurs, which is incompletely explained and may be an instrumentation and apparatus dependent effect. GRA

N81-12367# Sandia Labs., Albuquerque, N. Mex.
IMPROVED RECURSIVE FORMULA FOR CALCULATING SHOCK RESPONSE SPECTRA
D. O. Smallwood 1980 16 p refs Presented at Shock and Vibration Symp., San Diego, Calif., 21 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1315C; CONF-801033-1) Avail: NTIS HC A02/MF A01

Currently used recursive formulas for calculating the shock response spectra are based on an impulse invariant digital simulation of a single degree of freedom system. This simulation results in significant errors when the natural frequencies are greater than 1/6 the sample rate. It is shown that a ramp invariant simulation results in a recursive filter with one additional filter weight that can be used with good results over a broad frequency range including natural frequencies which exceed the sample rate. DOE

N81-12368# Gould-Brown Boveri, Greensburg, Pa.
HIGH TEMPERATURE GAS-INSULATED SYSTEMS Final Report
R. Dethlefsen, V. Tahiliani, P. Hughes, and J. Cronin Aug. 1980 252 p refs
(EPRI Proj. 7850-1)
(EPRI-EL-1500) Avail: NTIS HC A12/MF A01

The economic impact of, and the technical requirements for, high temperature operation (140 C) of SF6 insulated transmission lines are analyzed. Optimized design computer programs incorporate the present worth cost of losses. The cost of losses makes it uneconomic to raise the conductor temperature beyond about 110 C. For the same reason forced cooling is not attractive for steady operation. High temperature operation and forced

cooling are attractive for operating flexibility by allowing higher short term loading. Components for high temperature operation were developed and tested. These are insulators, conductor joints, and spiral welded enclosures. A 9 m (30 ft.) long section of a 362 kV prototype was built and tested in three modes of installation, open air, covered trench, and direct burial. The steady state and transient ampacity for high temperature operation were measured and compared with calculated data. Thermal radiation accounts for about 15% of the conductor enclosure heat transfer. DOE

N81-12369# Los Alamos Scientific Lab., N. Mex.
THICKENING OF A SHOCK FRONT BY THE GRAIN STRUCTURE OF A SOLID
R. C. Mjolsness Jul. 1980 25 p refs
(Contract W-7405-eng-36)
(LA-8410-MS) Avail: NTIS HC A02/MF A01

Three possible mechanisms: (1) microchanneling of a shock front; (2) variations of sound speed with direction in a grain; and (3) refraction of shock front direction on passing from grain to grain, all seem able to cause an initially steady one dimensional shock front to effectively thicken into a fluctuating, irregular shock front described by a shock front envelope. The shock front envelope diffuses in width to the order of one to several grain diameters, when it presumably reaches a steady state width. The treatment is confined to estimating the initial rate of widening of the shock front envelope by the simplest reasonable models, so no properties of the conjectured final state shock structure were established. DOE

N81-12370# Cornell Univ., Ithaca, N. Y. Dept. of Physics.
TWO-PHASE CRITICAL FLOW OF SATURATED AND SUBCOOLED LIQUIDS THROUGH VALVES
Emil J. Martinec, Jr. Dec. 1979 36 p refs Sponsored by DOE
(ANL/RAS/LWR-79-7) Avail: NTIS HC A03/MF A01

Two phase critical flow experiments were conducted to determine the effect of nonideal geometries on critical flow rate. A globe valve and a relief valve were tested, along with a 15 deg converging-diverging nozzle as a reference. Freon-11 was used as the working fluid; test conditions ranged from 5 to 60 C subcooling at inlet pressures of 550-2220 kPa. The data show that the two phase discharge coefficient is about 15% lower than the single phase discharge coefficient; in addition, critical flow rate can be predicted to within 20% by using the single phase discharge coefficient in simple analytical models. DOE

N81-12371# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
LASER LIKE APPROACH TO THE DYNAMICS OF CONVECTIVE INSTABILITIES
V. Degiorgio (CNR) Dec. 1979 20 p refs Presented at 7th Summer School on Quantum Optics, Wiezyca, Poland, 15-22 Sep. 1979
(Contract CNR-78-00901.02)
(CISE-1533) Avail: NTIS HC A02/MF A01

A self-consistent treatment of the single mode dynamics of the Rayleigh-Benard instability and the Soret-driven instability is discussed, starting from the general conservation equations and exploiting a technique similar to that used for laser instability. The same system of nonlinear equations is found to describe both instabilities. The analogy with the laser suggests the possibility of observing giant pulses in the transient well above threshold, and of measuring pretransitional fluctuations of the mode which goes instable. Author (ESA)

N81-12372# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
METHOD FOR CALCULATING TWO DIMENSIONAL SHEARED FLOW AT HIGH REYNOLDS NUMBERS [METHODES DE CALCUL DES ECOULEMENTS DECOLLES BIDIMENSIONNELS AUX GRAND NOMBRES DE REYNOLDS]
Jean-Claude LeBalleur and Henri Viviand Association Aeronautique et Astronautique de France 1980 58 p refs In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979 Sponsored by Direction des Recherches, Etudes et Technique and Service Technique de l'Aeronautique
(AAAF-NT-80-01; ISBN-2-7170-0597-8) Avail: NTIS HC A04/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

Two numerical methods (global and coupling methods, respectively) are presented. In the first, complete and truncated Navier-Stokes equations are solved for the entire system consisting of a thin viscous layer and a perfect fluid region. In the second, two distinct systems of equations are simultaneously solved. Applications of the global method to compressible fluids are discussed and the corresponding results given. A fully automated numerical coupling method is presented for solving certain problems associated with supersonic flow. Applications to boundary layer - shock wave interaction with sheared zones are given. Author (ESA)

N81-12373# Grenoble Univ. (France). Inst. de Mecanique.
CALCULATIONS FOR NONSTATIONARY LAMINAR FLOW SUBJECT TO AN AVERAGE DECELERATION WITH SHEARING [CALCULS D'ECOULEMENTS LAMINAIRES INSTATIONNAIRES DECELERES EN MOYENNE AVEC DECOLLEMENTS]
D. Charpin, J. L. Kueny, and G. Binder Paris Association Aeronautique et Astronautique de France 1980 33 p refs In FRENCH Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979
(AAAF-NT-80-02; ISBN-2-7170-0598-6) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

An off-center upstream is employed. Results are given for a divergent region. To limit viscosity effects associated with the scheme adopted, a method based on the alternating direction technique associated with exact fifth order Hermitian relations is employed. A high temporal and spatial accuracy is achieved. Author (ESA)

N81-12374# Centre National de la Recherche Scientifique, Orsay (France).
COMPACT NUMERICAL METHOD FOR THE SIMULATION OF SEPARATED VISCOUS FLOW, STATIONARY OR NOT. APPLICATION [METHODE NUMERIQUE COMPACTE POUR LA SIMULATION D'ECOULEMENTS VISQUEUX DECOLLES STATIONNAIRES OU NON. APPLICATION AUX CORPS PROFILES]
Olivier Daube and Loc TaPhuoc Paris Association Aeronautique et Astronautique de France 1980 31 p refs In FRENCH; ENGLISH summary Presented at 16th Colloq. d'Aerodyn. Appl., Lille, 13-15 Nov. 1979
(AAAF-NT-80-04; ISBN-2-7170-0600-I) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 40 (France and EEC) FF 45 (others)

A Hermitian method is proposed to solve unsteady Navier-Stokes equations. The problem of the onset of secondary vortices in the flow around a circular cyclinder which takes off suddenly is studied and the theoretical results are compared with experimental flow visualizations. The flow generated by the transversal oscillation of an elliptic cylinder is analyzed in detail from transient period to permanent periodic regime. Some characteristic properties of the phenomenon are evidenced. Author (ESA)

N81-12375# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.
PRINCIPLE OF LASER DOPPLER VELOCIMETER MEASUREMENTS IN A FULLY TRANSPARENT PUMP
H. Kannemans Jul. 1979 20 p refs Presented at Natl. Eng. Lab. Silver Jubilee Conf. on Fluid Mech., East Kilbridge, England, 27-29 Nov. 1979 Submitted for publication
(VKI-PREPRINT-1979-12) Avail: NTIS HC A02/MF A01

The applicability of Laser Doppler Velocity (LDV) measurements to pumps was studied. The shrouded impeller as well as the casing of the pump were made of plexiglass, which allows measuring in the rotating flow channel. The LDV system was applied in the forward scattering mode and the electronic processing system was of the counter type. The measurements are stored on a tape and analyzed by computer. Flow measurement from hub to shroud and from inlet to outlet are possible by a moving table on which the optical measurement is mounted.

Absolute and relative velocity components were calculated.
Author (ESA)

N81-12376# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A HEAT TRANSFER PREDICTION METHOD FOR TURBULENT BOUNDARY LAYERS DEVELOPING OVER ROUGH SURFACES WITH TRANSPIRATION
P. M. Ligrani, R. J. Moffat (Stanford Univ., Calif.), and W. M. Kays (Stanford Univ., Calif.) Sep. 1979 47 p refs Submitted for publication
(VKI-PREPRINT-1979-13) Avail: NTIS HC A03/MF A01

A heat transfer prediction method for Stanton number, skin friction coefficients and mean profiles in rough-wall boundary layers with and without transpiration and with and without favorable pressure gradients is presented. The near wall mixing length used to account for the effects of roughness is derived using mean velocity profile and shear stress data in the Couette flow regions of fully rough flows. The method also incorporates a wall temperature step based on the correlations of Dipprey and Saber sky. Predicted results show excellent agreement with the pipe flow experimental data and boundary layer experimental data for transitionally rough and fully rough conditions.
Author (ESA)

N81-12377# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
TURBULENT MIXING AND CONCENTRATION MEASUREMENT
C. Borrego and M. L. Riethmuller 1980 31 p refs Presented at Von Karman Inst. Lecture Ser. on Meas. and Predictions of Complex Turbulent Flows, Rhode Saint Genese, Belgium, 11-15 Feb. 1980 Submitted for publication
(VKI-PREPRINT-1980-8) Avail: NTIS HC A03/MF A01

A laser Doppler velocimeter and a laser scatter system were used to measure flow velocity and tracer concentration. Tests were carried out on a turbulent air jet of circular cross section exhausting into still air. Effects of turbulence on the mass transfer characteristics of the flow were studied using laser equipment in combination with an oil smoke tracer. The laser Doppler velocimeter was used to make velocity field measurements and the laser scatter system provided the instantaneous mass fraction of smoke at the same point in the flow field. The flow field was examined at locations varying from 2 to 20 diameters downstream of the nozzle. Parameters recorded at each downstream station were: mean axial velocity, mean concentration, fluctuating velocity and concentration, and velocity concentration correlation.
Author (ESA)

N81-12378# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
ELECTRON BEAM MEASUREMENTS OF THE DENSITY IN A HYPERSONIC TURBULENT BOUNDARY LAYER AT M = 9
R. P. Bartlett and J. K. Harvey Jan. 1980 15 p refs
(Contract AT/2037/084)
(IC-Aero-80-01) Avail: NTIS HC A03/MF A01

Density surveys were made, using the electron beam fluorescence technique, of the turbulent boundary layer formed on a highly cooled flat plate at M = 9. The technique is shown to be viable for measuring both the mean and fluctuating density. Estimates of turbulent shear stress, eddy viscosity and mixing length were made using the time-averaged conservation equations.
Author (ESA)

N81-12379# Aeritalia S.p.A., Torino (Italy). Space Sector.
STUDY OF HEAT REJECTION SYSTEMS Final Report
L. Bussolino Paris ESA Jul. 1980 183 p refs
(Contract ESTEC-4024/79-NL-AK(SC))
(TC-80-TR-0050; ESA-CR(P)-1340) Avail: NTIS HC A09/MF A01

The technology demonstration model (TDM) design developed for the Spacelab radiator heat rejection system is described. A pumped fluid loop radiator using Freon R21 as coolant is used. The following aspects of the design are included: thermal; hydraulic; structural; manufacturing process system control and performance; system tests; and component selection.
Author (ESA)

N81-12380# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
INVESTIGATION ON ADAPTATIONS TO AN EXISTING HEAT PIPE TEST PLATFORM FOR FLIGHT ON THE SPACELAB/SPAS Final Report
H. Koch, L. Speitkamp, J. Poeckentrup, M. Perdu, and J. Schrade Paris ESA Apr. 1980 109 p
(Contract ESTEC-3984/79-NL-AK(SC))
(ESA-CR(P)-1359) Avail: NTIS HC A06/MF A01

The characteristics of a heat pipe payload successfully flown on an ARIES sounding rocket are reviewed, and the compatibility with Shuttle/Spacelab Pallet Satellite (SPAS) systems and requirements are investigated, leading to a number of essential adaptations. Some additional desirable adaptations from the point of view of heat pipe experiments are identified. The definition of the thermal control system for the SPAS 01 mission, which includes the general thermal housekeeping, the heat input to the radiators due to mission dates, the heat rejection to the SPAS structure and the heat rejection to outer space is explained. The characteristics of the required variable conductance heat pipes are given for different environmental conditions.
Author (ESA)

N81-12381# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
TECHNICAL ASSISTANCE FOR THE EVALUATION OF FLUID LOOP COMPONENTS (PELTIER COOLER) Final Report
R. Best, W. Biemann, R. Bosch, U. Hingst, H. Kreeb, and W. Mueller Paris ESA 10 Jul. 1980 124 p
(Contract ESA-3774/78/NL-PP)
(DS-ERT-14/80; ESA-CR(P)-1361) Avail: NTIS HC A06/MF A01

The application of Peltier elements for refrigeration with source temperature control and heat rejection to a fluid loop was investigated using commercially available Peltier cooling elements. Peltier element performance with Peltier elements integrated into a cooler unit, investigation of possible temperature stabilization of the source side of the Peltier cooler arrangement, investigation of the necessary power supply and the power consumption for certain requirements for temperature range and heat load at the source, and investigation of mounting and integration aspects are discussed. Analytical calculations for the performance of Peltier elements in a cooler unit are relevant for a power supply, a temperature regulation system, and the design of bread board cooler unit.
Author (ESA)

N81-12382# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
A CALCULATION METHOD FOR INCOMPRESSIBLE BOUNDARY LAYERS WITH STRONG VISCOUS-INVISCID INTERACTION
A. E. P. Veldman 23 Jul. 1979 12 p refs Presented at the 3d GAMM-Conf. on Numerical Methods in Fluid Mech., Cologne, 10-12 Oct. 1979 and at Euromech Colloq. 116 on Laminar Separation and Transition, and Their Possible Connection with Cavitation, Wageningen, Netherlands, 28-30 May 1979
(NLR-MP-79029-U) Avail: NTIS HC A02/MF A01

The incompressible boundary layer calculation method differs from the classical in that an interactive boundary condition replaces the usually prescribed pressure. This boundary condition describes how the outer potential flow reacts on the presence of the boundary layer. The method is demonstrated on two problems: (1) laminar boundary layer with a separation bubble, and (2) the laminar flow near the trailing edge of a flat plate. Author (ESA)

N81-12383# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.
SIMULTANEOUS TWO DIMENSIONAL MEASUREMENTS WITH ONE COLOR LASER DOPPLER VELOCIMETER
L. Lourenco, C. Borrego, and M. L. Riethmuller Jun. 1980 19 p refs
(VKI-TM-28) Avail: NTIS HC A02/MF A01

The simultaneous measurement of both two-velocity components in a turbulent flow is proposed. Two pairs of orthogonally disposed one color laser beams are focused to a common point forming an interference grid fringe pattern; one pair is frequency

shifted. The probe volume is formed by the superposition of a system of stable fringes and an orthogonal system of fringes moving with a velocity proportional to the frequency difference. When a particle crosses this probe volume, light is scattered and a composite Doppler signal is obtained. The technqiue is particularly suited for flows where a main direction may be determined. Measurements made in order to validate this technique are described. Author (ESA)

N81-12384# Thermal Systems Engineering, Inc., Woburn, Mass.
HEAT RECOVERY DEVICES, NEW Final Report, 1 Mar. - 31 Oct. 1979
Andrew J. Syska and A. Brzezinski Apr. 1980 50 p refs
(Contract GRI-5011-341-0121)
(PB80-205438: GRI-78/0041) Avail: NTIS HC A03/MF A01 CSCL 13A

A concept was developed for a compact and lightweight jet impingement recuperator suitable for recovering heat from residential and commercial gas fired heating systems. Heat transfer and pressure drop analyses were completed confirming feasibility of the concept. Preliminary, cost effective desigh for the recuperator was also completed and optimized for compactness and for low pressure drop compatible with natural chimney drafts. GRA

N81-12997# Cornell Univ., Ithaca, N. Y. Sibley School of Mechanical and Aerospace Engineering.
PROBE MEASUREMENTS IN MULTI-DIMENSIONAL REACTING FLOWS
F. C. Gouldin *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 14 p refs (For primary document see N81-12993 03-99)
(Grant NSG-3019)
Avail: NTIS HC A13/MF A01

N81-13000# Oxford Univ. (England). Dept. of Engineering Science.
HEAT TRANSFER RATE AND FILM COOLING EFFECTIVENESS MEASUREMENTS IN A TRANSIENT CASCADE
D. L. Schultz, M. L. G. Oldfield, and T. V. Jones *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 9 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13004# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
VELOCITY MEASUREMENT TECHNIQUES IN LIQUID SPRAYS USING LASER DOPPLER VELOCIMETRY
M. L. Riethmuller and J.-M. Buchlin *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 7 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

N81-13015# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A METHOD FOR THE MEASUREMENTS OF MIXING PROPERTIES IN A FLOW
C. Borrego and D. Olivari *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 16 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-12385*# Block Engineering, Inc., Cambridge, Mass.
DESIGN STUDIES FOR A FAR INFRARED ABSOLUTE SPECTROMETER FOR THE COSMIC BACKGROUND EXPLORER Final Technical Report
Norman J. E. Johnson 23 Jan. 1980 266 p refs
(Contract NAS5-25535)
(NASA-CR-160051: BE-79-808) Avail: NTIS HC A12/MF A01 CSCL 14B

Unrelenting symmetry of design is required to assure the thermal balance of a cryogenically cooled, rapid scan interferometer spectrometer to be mounted in vacuum with the Cosmic Background Explorer liquid helium dewar. The instrument receives inputs from Winston cone optical flux collectors, one open to space and a second coupled to a black body reference source. A differential instrument, the spectrometer produces outputs corresponding to the Fourier transform of the spectral radiance difference between the two inputs. The two outputs are sensed by four detectors, two optimized for shorter wavelength response, and two optimized for longer wavelengths. The optical design, detector and signal channel, system sensitivity, mechanics, thermal control and cryogenics, electronics and power systems, command and control, calibration, system test requirements, and the instrument interface are discussed. Recommendations for continued work are indicated for the superconducting reflective horns, the motor bearing and drive, and design detail. A.R.H.

N81-12386*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERFEROMETRIC ANGLE MONITOR Patent Application
Peter O. Minott, inventor (to NASA) Filed 8 Oct. 1980 11 p
(NASA-Case-GSC-12614-1; US-Patent-Appl-SN-195227) Avail: NTIS HC A02/MF A01 CSCL 14B

Two mutually coherent light beams formed from a single monochromatic light source and were directed to a reflecting surface of a rotatable object. They were reflected into an imaging optical lens having a focal plane optically at infinity. A series of interference fringes were formed in the focal plane which were translated linearly in response to angular rotation of the object. Photodetectors were located adjacent the focal plane to detect the fringe translation and output a signal in response to the translation. The signal was fed to a signal processor which was adapted to count the number of fringes detected and develop a measure of the angular rotation and direction of the object. NASA

N81-12387*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTIPRISM COLLIMATOR Patent Application
Peter O. Minott, inventor (to NASA) Filed 8 Oct. 1980 13 p
(NASA-Case-GSC-12608-1; US-Patent-Appl-SN-195228) Avail: NTIS HC A02/MF A01 CSCL 14B

A special purpose optical collimator system which generates multiple collimated light beams, with precisely related angular separation of the beams is described. The system is comprised of a stack of relatively flat plate like refracted prisms in the form of wedges, each having a specified angular deviation, mounted on top of one another in a fixture which holds the wedges so that they are adapted to operate at minimum angular deviation and thus are relatively insensitive to rotational and angular changes. A collimated source of monochromatic light generated, for example, by a helium neon laser and a collimated beam expander provides a common incident beam to the wedges whereupon a plurality of, for example, equally spaced emergent beams are provided. NASA

N81-12388*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MINIATURE SPECTRALLY SELECTIVE DOSIMETER Patent Application
Richard R. Adams, Ian O. MacConochie, inventors (to NASA), and Bordie D. Poole, Jr. Filed 8 Oct. 1980 12 p
(NASA-Case-LAR-12469-1; US-Patent-Appl-SN-195223) Avail: NTIS HC A02/MF A01 CSCL 14B

A miniature spectrally selective dosimeter capable of measuring selected bandwidths of radiation exposure on small mobile areas is proposed. The dosimeter is a combination of photovoltaic detectors, electrochemical integrators (E-cells) and filters in a compact case which is easily attached close to and substantially parallel to the surface being measured. In one embodiment two photovoltaic detectors, two E-cells amd three filters are packaged in a small case with attaching means

consisting of a clip to clip over a side piece of an eye glass frame. In a further embodiment, the electro-optic elements are packaged in a wristwatch case with attaching means being a watchband. The filters in all embodiments allow only selected wavelengths of radiation to be detected by the photovoltaic detectors and then integrated by the E-cells. NASA

N81-12389*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PYROELECTRIC DETECTOR ARRAYS Patent Application
Archibald L. Fripp, inventor (to NASA) Filed 29 Sep. 1980 8 p
(NASA-Case-LAR-12363-1; US-Patent-Appl-SN-191748) Avail: NTIS HC A02/MF A01 CSCL 14B

A pyroelectric detector array and the method for making it is described. A series of holes formed through a silicon dioxide layer on the surface of a silicon substrate forms the mounting fixture for the pyroelectric detector array. A series of nontouching strips of indium are formed around the holes to make contact with the backside electrodes and form the output terminals for individual detectors. A pyroelectric detector strip with front and back electrodes is mounted over the strips. Biasing resistors are formed on the surface of the silicon dioxide layer and connected to the strips. A metallized pad formed on the surface of layer is connected to each of the biasing resistors and to the film to provide the ground for the pyroelectric detector array. NASA

N81-12390*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
***HOT FOIL TRANSDUCER SKIN FRICTION SENSOR* Patent Application**
Thomas Vranas, inventor (to NASA) Filed 14 Aug. 1980 12 p
(NASA-Case-LAR-12321-1; US-Patent-Appl-SN-178195) Avail: NTIS HC A02/MF A01 CSCL 14B

An improved hot wire transducer skin friction sensor is described. The device utilizes foil transducers with only one edge exposed to the fluid flow. The surfaces are polished producing a foil transducer that does not generate turbulence while sufficiently thick to carry the required electrical current for high temperature fluid flow. The assembly utilized a precut layered metal sandwich with attached electrodes eliminating a need for welding and individual sensor calibration. NASA

N81-12391*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
TEST AND EVALUATION OF WATER VAPOR RADIOMETERS Final Report, 31 Mar. 1976 - 29 Feb. 1980
James Moran Jun. 1980 41 p refs
(Contract NAS5-20975)
(NASA-CR-160043) Avail: NTIS HC A03/MF A01 CSCL 14B

The accuracy of very long baseline interferometry in geodetic and astrometric applications is primarily limited by the propagation delays through the troposphere. The part of this delay that is most difficult to predict is due to atmospheric water vapor which can contribute up to about 40 cm of excess propagation path at microwave frequencies. The water vapor content in the atmosphere is variable and is not well correlated with surface meteorological variables. The brightness temperature measured near the transition of water vapor at 22.2 GHz and the propagation delay due to water vapor, or wet path length, are well correlated. This correlation is not perfect because the absorption coefficient and index of refraction do not have the same dependence on temperature and pressure. S.F.

N81-12392*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
AVHRR/1-FM ADVANCED VERY HIGH RESOLUTION RADIOMETER Final Report
Feb. 1979 311 p refs
(Contract NAS5-22497)
(NASA-CR-160059) Avail: NTIS HC A14/MF A01 CSCL 14B

The advanced very high resolution radiometer is discussed. The program covers design, construction, and test of a breadboard model, engineering model, protoflight model, mechanical/structural model, and a life test model. Special bench test and calibration equipment was developed for use on the program. The flight model program objectives were to fabricate, assemble and test four of the advanced very high resolution radiometers along with a bench cooler and collimator. S.F.

N81-12393# Cornell Univ., Ithaca, N. Y. Lab. of Atomic and Solid State Physics.
X-RAY HOLOGRAPHY WITH X-RAYS Final Report, 1 Jul. 1979 - 31 Mar. 1980
Herbert Mahr May 1980 8 p ref
(Contract N00014-77-C-0543)
(AD-A090807; FR-1) Avail: NTIS HC A02/MF A01 CSCL 14/5

A study was made of the possibility to produce X-ray holograms near 44 angstroms with a novel double Fresnel Zone plate arrangement. Locally available sources (CHESS) are not suitable, however. GRA

N81-12394# National Research Council of Canada, Ottawa (Ontario).
A COMPARISON OF METHODS FOR CALIBRATION AND USE OF MULTI-COMPONENT STRAIN GAUGE WIND TUNNEL BALANCES
R. D. Galway (National Aeronautical Establishment, Ottawa, Ontario) Mar. 1980 47 p refs
(AD-A090484; NRC-18227; NAE-LR-600) Avail: NTIS HC A03/MF A02 CSCL 14/2

A method is presented for calibration of strain-gauge balances which does not require that the components can be loaded independently. Applicable to both 'internal' and 'external' types of balance, the procedure uses a single varying calibration load to determine all linear and non-linear calibration coefficients. Constant 'secondary' loads on one or more components are unnecessary, although they may be used if desired. The usual iterative solution of the second order balance equations is outlined, and an approximate non-iterative scheme is included for completeness, though not recommended. Two methods of accounting for dependency of the calibration coefficients on the signs of the component loads are presented. A concept of 'buoyancy' is introduced to simplify the application of force balance tares, and a procedure for determining the component outputs for absolute zero load (the 'buoyant' offsets) is given. Balance data at a series of model attitudes are used to define these offsets, and also the coefficients in the equations defining the component load distribution of the tare weight at any attitude. The topics covered are ideally suited to formulation and solution by matrix methods, which have been used throughout.
Author (GRA)

N81-12395# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.
RING LASER GYRO Status Report
Thomas J. Hutchings 9 Sep. 1980 15 p refs Presented at AIAA Strategic/Tactical Missile Systems and Space Sci. Meeting
(AD-A090643) Avail: NTIS HC A02/MF A01 CSCL 17/7

A general review of laser gyros is presented. Basic concepts of the gas ring laser are reviewed. These include the 'lock-in' phenomena, geometric performance factors, and other problem areas. Various biasing methods to eliminate some of these basic problems are presented. Salient features of the laser gyro which are unique for gyro instruments are shown with data. Various laser gyro design parameters are reviewed with respect to projected performance requirements for various applications.
GRA

N81-12396# Philips Labs., Briarcliff Manor, New York. Component and Device Research Group.
DEVELOPMENT OF AN ELECTROPHORETIC IMAGE DISPLAY Quarterly Technical Report, 1 May - 31 Jul. 1980
Richard Liebert, Joseph Lalak, and Karl Witting Aug. 1980 18 p
(Contract MDA903-79-C-0939; DARPA Order 3802)
(AD-A090574) Avail: NTIS HC A02/MF A01 CSCL 14/2

The purpose of this work is to develop a 350 x 600 element X-Y addressed electrophoretic image display (EPID). Devices with improved Mylar layers have been fabricated using the photolithographic masks designed for the 512 character display. This improvement was achieved by using a new system and better

pressing blocks. The photolithographic processes and ion-beam milling of the aluminum consistently have given good results. Ion-beam milling of the Mylar requires further development to ensure complete removal of material from the wells without destruction of the underlying electrode. Those areas of the completed devices which operated demonstrated good contrast at 2 lp/mm with the expected drive voltages. The display driver was redesigned to use a new high-voltage shift register for the row and column drivers, and a multiplexer was added to permit future access to any pixel, thereby eliminating the constraints imposed by a character generator. Construction of the driver has begun, and the printed circuit board for mounting the display has been ordered. The system for depositing In2O3/SnO2 (ITO) transparent grid electrodes is in operation. Transparent conducting ITO films have been deposited on glass and Mylar. Additional work is required to establish the deposition parameters necessary for reproducibly obtaining the desired properties of ITO on Mylar. GRA

N81-12397# Hughes Research Labs., Malibu, Calif.
DIRECT-WRITE ION LITHOGRAPHY Interim Report, 18 Sep. 1979 - 18 Apr. 1980
R. P. Vahrenkamp Griffiss AFB, N.Y. RADC Jul. 1980 37 p refs
(Contract F19628-79-C-0181; AF Proj. 2305)
(AD-A090607; RADC-TR-80-215) Avail: NTIS HC A03/MF A01 CSCL 14/5

For a practical ion-lithography column of 150 kV, the light elements Li, Be, B, C, and Si were found to be the most promising for resist exposure. With the exception of Li, these elements emit doubly charged ions when used on a liquid metal (LM) ion source. Lithium, although highly reactive, can be operated as a single-element species, while the others must be used in alloys. Mass spectra for alloys of Be-Au, Si-Au, and B-Pt were obtained and showed significant fractions of the desired ion species. A new LM ion source structure (needle and heater assembly) was tested and found to improve the stability of the Be-Au ion emission. This ion source structure appears to be suitable for all elements and alloys considered for resist exposure. The results show that 0.5 micrometers of resist can be exposed with Be- ions at an energy of 60 to 80 keV while the same exposed depth requires 175 to 200 keV for Si- ions. Focused-beam exposures in PMMA were made using the Be40-Au60 alloy as the ion source material. Since the focused beam was not mass separated, the gold was implanted along with the beryllium. Because of the short range of the gold ions, polymerization of the resist occurred at doses greater than approx. 9 x 10 to the 12th power Be(--)/sq cm. The low Be(--) dose at 55 kV is not sufficient for maximum range, and most of the exposed depth is due to the combination of Be- and Be(--) ions. GRA

N81-12398# Los Alamos Scientific Lab., N. Mex.
DYMAC DIGITAL ELECTRONIC BALANCE
Melvin M. Stephens Jun. 1980 42 p refs
(Contract W-7405-eng-36)
(LA-8313-M) Avail: NTIS HC A03/MF A01

The Dynamic Materials Accountability (DYMAC) System at LASL integrates nondestructive assay (NDA) instruments with interactive data processing equipment to provide near real time accountability of the nuclear material in the LASL Plutonium Processing Facility. The most widely used NDA instrument in the system is the DYMAC digital electronic balance. The DYMAC balance is a commercial instrument that has been modified at LASL for weighing material in gloveboxes and for transmitting the weight data directly to a central computer. This manual describes the balance components, details the LASL modifications, reviews a DYMAC measurement control program that monitors balance performance, and provides instructions for balance operation and maintenance. DOE

N81-12399# Brookhaven National Lab., Upton, N. Y.
WATER VAPOR PRESSURE GAUGE
D. Edwards, Jr. and D. Gillette 1980 9 p Presented at 27th Am. Vacuum Soc. Conf. Detroit, 14-17 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28267) Avail: NTIS HC A02/MF A01

An inexpensive pressure gauge, able to measure the N2 and H2O components within a vacuum system in the pressure range 1 mu to 400 mu is described and results of tests of the device are reported. DOE

N81-12400# Brookhaven National Lab., Upton, N. Y.
MASS MEASUREMENT WITH THE ELECTRON MICROSCOPE
Joseph S. Wall 1979 32 p refs Presented at Proc. of the 13th Ann. Scanning Electron Microscopy Symp., 1979 Sponsored by DOE
(BNL-25536; CONF-790418-2) Avail: NTIS HC A03/MF A01

The use of electron scattering measurements performed in the electron microscope as a means of measurement of particle molecular weight is described. Various potential sources of errors are identified and estimated where possible. Specimen preparation and observation conditions to minimize errors are described, and fd phage is presented as an example of analysis and an illustration of the accuracy obtainable at low dose. Author

N81-12401# Sandia Labs., Albuquerque, N. Mex.
PORTABLE INSTRUMENTATION FOR SOLAR ABSORPTANCE AND EMITTANCE MEASUREMENTS
R. B. Pettit and A. R. Mahoney 1980 20 p refs Presented at Line-Focus Solar Thermal Energy Technol. Development Conf., Albuquerque, N. Mex., 9 Sep. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1541C; CONF-800955-3) Avail: NTIS HC A02/MF A01

Two portable instruments, one designed for solar absorptance and the other for emittance measurements, were evaluated. A solar spectrum reflectometer was used for solar absorptance measurements while a model AE emissometer was used to measure the emittance for an 80 C blackbody. Both instruments are manufactured by Devices and Services Co., Dallas, TX. The solar spectrum reflectometer uses four different detector/filter combinations to match an air mass two solar spectral distribution. The solar absorptance values measured for a variety of solar coatings were determined to an accuracy of +-0.02 absorptance units. For second surface solar mirrors, the instrument underestimates the hemispherical solar reflectance when the reflecting surface is more than 0.2 mm away from the measurement port. The emissometer consists of a heated measurement head and separate display unit. The accuracy of this instrument is better than +-0.03 emittance units for black chrome solar coatings and better than +-0.06 emittance units for all coatings studied. DOE

N81-12402# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A SECOND GENERATION PORTABLE SPECULAR REFLECTOMETER
J. M. Freese 1980 15 p refs Presented at Line-Focus Solar Thermal Energy Technol. Development Conf., Albuquerque, N. Mex., 9 Sep. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1509C; CONF-800955-4) Avail: NTIS HC A02/MF A01

The second generation design of a portable specular reflectometer is discussed. The instruments respond linearly (+-0.006 transmission units) to variations in the intensity of incident and reflected beams and the readings are not affected by the presence of stray light. As a result of this feature, the reflectometer is well suited for outdoor field use in a normal sunlight environment. A drift problem due to temperature was observed in the detector/preamp at temperatures > 100 F. A major improvement in the second generation reflectometer is the use of larger optics to allow averaging over a greater surface area of a mirror. The reflectometer has the capability of a straight through beam configuration, allowing direct determination of the signal level corresponding to 100% reflectance. This capability also allows the user to measure the specular transmittance of materials. A microprocessor can be added to the output of the detector as an option to display percent reflectance values and mean and standard deviations of measurements made. DOE

N81-12403# Centro Jnformazioni Studi Esperienze, Milan (Italy).
MEASUREMENT BY AN AUTOMATED HOLOGRAPHIC SYSTEM OF STRAIN DISTRIBUTION IN TEST SPECIMENS OF COMPOSITE STRUCTURAL MATERIALS

P. Delvo, F. Libbra, L. Rizzi, P. Rossi, and G. Maggioni Dec. 1979 12 p Presented at IUTAM Symp. on Opt. Methods in Mech. of Solids, Poitiers, France, 10-14 Sep. 1979
(CISE-1529) Avail: NTIS HC A02/MF A01

An investigation of the behavior of nonhomogeneous materials such as concrete or rock by means of holographic interferometry is presented. Double exposure holograms were used to determine the strain distribution on the whole surface of the sample. Holograms are recorded while the specimens are loaded by a press in a controlled situation. A computer controlled positioner gives the amount of the vectorial displacement of each point chosen on the sample. Preliminary results of nonhomogenous material specimen tests are reported. Author (ESA)

N81-12404# Unilever Research, Vlaardingen (Netherlands). Editorial Dept.
A CHECK PANEL FOR THE MSE ANALYTICAL ULTRACENTRIFUGE
J. vanderMeer 1980 9 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

A check panel by which various parameters can be measured using a two channel oscilloscope is described. The checks can be done at low rotor speed without altering the sample. The synchronization pulses, the analog, infrared and sampling signals, the temperature regulating system, and the motor speed, are sampled. Author (ESA)

N81-13005# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
A METHOD FOR MEASURING SHORT TIME RESPONSE BY DETERMINING VELOCITY AND TEMPERATURE VARIATIONS IN HIGH TEMPERATURE FLOWS [METHODES DE MESURE A COURT TEMPS DE RESPONSE POUR LA DETERMINATION DES FLUCTUATIONS DE VITESSE ET TEMPERATURE DANS LES ECOULEMENTS A TEMPERATURE ELEVEE]
Marc Chardenel, Yves LeBot, Philippe Magre, Jean Labbe, and Pierre Moreau *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs In FRENCH; ENGLISH summary (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-12405*# Westinghouse Electric Corp., Pittsburgh, Pa.
PARAMETRIC INFRARED TUNABLE LASER SYSTEM
M. Garbuny, T. Henningsen, and J. R. Sutter Nov. 1980 115 p refs
(Contract NAS1-13752)
(NASA-CR-159310; Rept-80-9C1-NASSA-R2) Avail: NTIS HC A06/MF A01 CSCL 20E

A parametric tunable infrared laser system was built to serve as transmitter for the remote detection and density measurement of pollutant, poisonous, or trace gases in the atmosphere. The system operates with a YAG:Nd laser oscillator amplifier chain which pumps a parametric tunable frequency converter. The completed system produced pulse energies of up to 30 mJ. The output is tunable from 1.5 to 3.6 micrometers at linewidths of 0.2-0.5 /cm (FWHM), although the limits of the tuning range and the narrower line crystals presently in the parametric converter by samples of the higher quality already demonstrated is expected to improve the system performance further. R.K.G.

N81-12406# Committee on Commerce, Science, and Transportation (U. S. Senate).
LASER RESEARCH AND APPLICATIONS
Washington GPO 1980 32 p Presented to the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., Nov. 1980
(GPO-66-074) Avail: NTIS Avail: Committee on Commerce, Science, and Transportation

Development of directed energy weapons -- the principal application of which is defense against offensive nuclear weapons -- might move the superpowers into a postnuclear era and offers the potential to effect a dramatic shift in strategic military posture. Development of fusion energy, for which laser technology offers promise rivaling magnetic confinement, will provide an inexhaustible supply of electricity without the adverse externalities associated with conventional nuclear and coal power generation. Laser fiber optics wideband communications technology is destined to provide home and office 'communications centers'. Laser technology seems certain to revolutionize chemistry, facilitating chemical compositions and decompositions. The technology shows considerable promise in potential civilian space applications, such as remote sensing of the Earth and its environment, power transmission, and space vehicle propulsion. Author

N81-12407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OFF-AXIS COHERENTLY PUMPED LASER Patent Application
Gerhard A. Koepf, inventor (to NASA) (Phoenix Corp.) Filed 23 Oct. 1980 16 p Sponsored by NASA
(NASA-Case-GSC-12592-1; US-Patent-Appl-SN-199766) Avail: NTIS HC A02/MF A01 CSCL 20E

A coherently optically pumped laser system is described. A pump laser beam propagates through a laser medium contained in a degenerate cavity resonator in a controlled multiple round trip fashion in such a way that the unused pump beam emerges from an injection aperture at a different angle from which it enters the resonator. The pump beam is angularly injected off of the central axis of the resonator body whereupon the pump beam alternately undergoes spreading and focusing while pumping the laser medium by a process of resonant absorption. The emergent pump beam can also be used as a second pump beam source by being reinjected back into the cavity or it can be used for pumping another laser. NASA

N81-12408# National Bureau of Standards, Washington, D.C.
LASER COOLING AND TRAPPING OF NEUTRAL ATOMS Interim Report
Willian D. Phillips Sep. 1980 5 p
(Contract N00014-80-F-0035)
(AD-A090760; IR-FY-80) Avail: NTIS HC A02/MF A01 CSCL 20/13

Recent proposals for laser trapping of neutral atoms require that the trapped atoms have very low kinetic energy. We have studied the technique of cooling free neutral atoms using radiation pressure and have examined some of the processes which limit the cooling. In particular, we have found large and previously unexpected effects due to optical pumping which not only impair cooling but mask the effects of cooling, making the interpretation of experiments ambiguous. We propose methods for reducing the ambiguity in atom cooling experiments and for alleviating the effects of optical pumping which inhibit cooling. GRA

N81-12409# Naval Research Lab., Washington, D. C.
THREE DIMENSIONAL NON-LINEAR THEORY OF THE FREE ELECTRON LASER
P. Sprangle and Cha-Mei Tang 22 Sep. 1980 20 p refs
(AD-A090321; NRL-MR-4280) Avail: NTIS HC A02/MF A01 CSCL 20/5

This paper deals primarily with 3-D effects and efficiency enhancement methods in a steady state FEL amplifier configuration. We treat finite transverse dimension effects associated with (1) the wiggler field, (2) electron beam, and (3) radiation beam. Our formulation includes efficiency enhancement schemes such as spatially contouring the wiggler field as well as accelerating the electron beam. Finally, a 3-D example of a 10.6 microns FEL with enhanced efficiency is given. GRA

N81-12410# Rockwell International Corp., Anaheim, Calif. Electronics Research Center.
ROOM TEMPERATURE, CW, SINGLE MODE LASER Final Technical Report
P. D. Dapkus, J. J. Coleman, and R. D. Dupuis 1 Oct. 1980 78 p refs
(Contract N00173-79-C-0025)
(AD-A090326; C80-636/501) Avail: NTIS HC A05/MF A01 CSCL 20/5

This report describes results obtained in the study of single mode cw room temperature diode lasers. Three device designs are analyzed and studied. Detailed calculations on the modal properties of channel guide lasers have been performed. Experimental studies of the transverse junction stripe laser, channel guide laser, inverted channel guide laser and self-aligned structure laser have been made. This last device has operated on a fundamental mode with cw room temperature thresholds much lower than 100 mA. Device packaging is described including a Si submount and an optical fiber pigtail in a hermetically sealed package. Details of the developments undertaken and the results obtained are discussed. GRA

N81-12411# White Sands Missile Range, N.Mex. Instrumentation Directorate.

EXPERIMENTALLY DETERMINED RELATIONSHIP BETWEEN EXTINCTION AND LIQUID WATER CONTENT

Dorothy Bruce, Charles W. Bruce (Atmospheric Sciences Lab., White Sands, N. Mex.), Young Paul Yee (Atmospheric Sciences Lab., White Sands, N. Mex.), and Hans Burket (New Mexico State Univ., Las Cruces) Jun. 1980 10 p refs

(AD-A090368) Avail: NTIS HC A02/MF A01 CSCL 20/6

This paper reports the results of environmental chamber measurements of extinction coefficients at CO2 laser wavelengths and of liquid water content (LWC) of a variety of droplet size distributions. The liquid water content measurements were made with two recently developed systems which are described. The results are in general agreement with calculated results based on measured fog droplet size distributions and give further verification to prediction of a unique linear relation between extinction at approximately 11 micrometer and liquid water content of fogs for all size distributions with maximum particle radii less than or approximately equal to 14 micrometers. GRA

N81-12412# Army Computer System Command, Fort Belvoir, Va. Night Vision and Electro-Optics Labs.

PULSE CODE MODULATION OF CO2 TEA LASER PULSE

Robert S. Rohde and Rudolph G. Buser Jun. 1980 10 p refs

(AD-A090436) Avail: NTIS HC A02/MF A01 CSCL 20/6

The CO2 TEA laser pulse is characterized by a gain-switched spike followed by a slow decaying tail. As a ranging waveform, the tail with its slow fall time does not contribute to the device's accuracy in ranging measurements. Elimination of this tail, with resulting increased energy in the spike, by optimization of the gas ratios, has been sought after. On the other hand, utilization of the entire pulse to include the tail, leads to the concept of multifunctional applications such as range finding and Cooperative Battlefield Identification Friend or Foe (CBIFF). Application of CBIFF requirements would utilize the modulated tail by transferring coded telegrams to the target being interrogated. The tail portion of the CO2 TEA laser waveform is approximately 2 to 4 microsec long. Depending on the achievable bandwidths for the modulator and receiver system, 10 to 100 bits of information can possibly be transmitted on a single CO2 TEA laser pulse. A number of applications besides CBIFF can be explored including communication between two vehicles, data transmission, and precision ranging to name a few. In this report, the CO2 TEA laser pulse tail is electro-optically (EO) modulated with a polarization sensitive switch capable of 5 MHz repetition rate and 100 nanosecond pulsewidths. With this capability, three operational modes can be realized; namely, (1) pulse shaping/sharpening of the gain-switched spike for precision ranging, (2) information transfer via modulation of tail, or (3) combining (1) and (2) on the same laser pulse. Mode no. 2 has been demonstrated and will be presented in this report. GRA

N81-12413# Army Electronics Research and Development Command, Fort Monmouth, N. J.

SPATIAL COHERENCE AND INTENSITY PROPERTIES OF QUASIHOMOGENEOUS OPTICAL SOURCES

Edward Collett Jun. 1980 13 p refs

(AD-A090378) Avail: NTIS HC A02/MF A01 CSCL 20/6

Recently, theoretical and experimental investigations have shown that partially coherent sources can be as directional as a laser beam. This is due to the fact that an optical source must be simultaneously characterized by its degree of coherence and its intensity distribution across the optical surface. This theoretical prediction has been confirmed experimentally. In this paper the theoretical development of the quasihomogeneous optical source concept is reviewed along with some of the experimental results. No attempt will be made to present a detailed derivation of the fundamental equations as they have been fully developed in the open literature and can be found in the cited references. GRA

N81-12414# University of Southern California, Los Angeles.

EXCIMER POTENTIAL CURVES Final Report

H. S. Taylor, M. Valley, C. Jung, C. Watts, and F. Bobrowicz 1980 235 p refs

(Contract N00014-77-C-0102)

(AD-A090516) Avail: NTIS HC A11/MF A01 CSCL 07/4

The purpose of this project is the development of semi-empirical and theoretical methods of obtaining reasonably accurate potential curves for diatomic excimer systems. These curves are of importance for applications to fluorescence spectra, stimulated emission coefficients, excimer laser development and electron impact excitations. GRA

N81-12415# Centre National de la Recherche Scientifique, Orsay (France). Lab. Aime Cotton.

LINE SHAPES IN LASER EXPERIMENTS Technical Report, Oct. - Nov. 1979

R. Vetter and P. R. Berman 1979 18 p refs Prepared in cooperation with New York Univ., N.Y.

(Contract N00014-77-C-0553)

(AD-A090766) Avail: NTIS HC A02/MF A01 CSCL 20/5

A brief review of recent developments in line shape studies using laser spectroscopy is presented. Experiments are discussed in which the absorption or emission line profiles associated with various transitions in a vapor can be used to provide useful information concerning the atomic sample being tested. In particular, ways in which collisional effects manifest themselves in line shapes are described and the manner in which collision cross section can be extracted from these line shapes is discussed. Illustrative experiments using methods of linear spectroscopy, two photon spectroscopy and saturation spectroscopy are presented. GRA

N81-12416# Tel-Aviv Univ. (Israel). Quantum Electronics Lab.

A UNIFIED THEORY OF MAGNETIC BREMSSTRAHLUNG, ELECTROSTATIC BREMSSTRAHLUNG, COMPTON-RAMAN SCATTERING AND CERENKOV-SMITH-PURCELL FREE ELECTRON LASERS Interim Report, 1979 - 1980

A. Gover and P. Sprangle May 1980 80 p refs

(Grant AF-AFOSR-0073-80; AF Proj. 2301)

(AD-A090559; TAU-1980/81; SR-2; AFOSR-80-0934TR) Avail: NTIS HC A05/MF A01 CSCL 20/5

This article discusses in a comparative way the main operating parameters of various free electron lasers, providing a useful tool for laser design, and for comparative evaluation of the various lasers. We show that the various kinds of FELs satisfy the same gain-dispersion relation and differ only in a single coupling parameter k. The different gain regimes which are common to all FELs are delineated. We find the small signal gain in all the gain regimes (warm and cold beam, low or high gain, single electron, collective or strong coupling interaction). The laser gain parameter, radiation extraction efficiency, maximum power generation and spectral width are given and compared in the various kinds of FELs and gain regimes. The maximum power generation of all FELs (except Compton-Raman scattering) is shown to be limited by an interaction region width parameter. This parameter and consequently the laser power is larger in the highly relativistic limit by a factor in all bremsstrahlung FELs in comparison to Cernkov-Smith-Purcell FELs. Some expressions which were derived earlier for the magnetic bremsstrahlung FEL, like the expression for gain in the low gain regime with space charge effect correction and the low gain expression for efficiency are shown to be special cases of more general expressions. GRA

N81-12417# Bendix Corp., Kansas City, Mo.

LASER CUTTING PLASTIC MATERIALS

R. A. VanCleave Aug. 1980 42 p refs

(Contract DE-AC04-76DP-00613)

(BDX-613-2476) Avail: NTIS HC A03/MF A01

A 1000 watt CO2 laser was demonstrated as a reliable production machine tool for cutting of plastics, high strength reinforced composites, and other nonmetals. More than 40 different plastics were laser cut, and the results are tabulated. Applications for laser cutting described include fiberglass reinforced laminates, Kevlar/epoxy composites, fiberglass reinforced phenolics, nylon/epoxy laminates, ceramics, and disposal tooling made from acrylic. DOE

N81-12418# Bendix Corp., Kansas City, Mo.
LASER APPLICATIONS
R. T. Horn Jul. 1980 41 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2448) Avail: NTIS HC A03/MF A01

Laser processing in production is complementary with existing manufacturing methods. Feasible production applications of laser processing are identified and a technological basis for development work in other laser related studies is provided. From these efforts, basic methods for successful laser applications were established. These methods require an understanding of the power and focusing parameters of lasers. Using these methods processes for welding, drilling, cutting, alignment, and inspection were developed. In particular, high speed laser stripping and contouring of flexible cables has become a major production application. Laser welding of cast aluminum cases and gold plated integrated circuit containers was also shown to be a viable backup process for present techniques. Alignment schemes for power lasers and positioning techniques accurate to less than 2.5 micron m were also proven. E.D.K.

N81-12419# Centro Informazioni Studi Esperienze, Milan (Italy).
HIGH ACCURACY DISTANCE MEASUREMENT BY TWO-WAVELENGTH PULSED LASER SOURCE
B. Querzola Dec. 1978 107 p refs
(Contract CNR-73-01435)
(CISE-N-189) Avail: NTIS HC A06/MF A01

The two-wavelength method permits fractional accuracies better than 1 ppm in ranging, and it has been so far applied only to continuous laser sources. An experiment was conducted to determine whether high power pulse lasers can be successfully used with this method, and to check the system feasibility. The main cause of error concerns threshold crossing in pulse discrimination specially in the presence of amplitude fluctuations. An analysis of error causes affecting such measurements was performed. Measurements on 5 and 13 km distances by pulsed ruby laser PTM emission (wavelength 6943 A) and its second harmonic (wavelength 3472 A) using a 20 psel accuracy time were made. Such measurements show that two-wavelength pulsed laser telemeters can reach 1 ppm accuracies for distances exceeding a few kilometers. Author (ESA)

N81-12420# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
SPACEBORNE LASER RANGE AND RANGE RATE FINDER
T. Halldorsson, R. Kleinbauer, W. Krause, Langerholc, D. Meissner, W. Nagl, and C. Zeckau Paris ESA 31 Mar. 1980 291 p refs
(Contracts ESTEC-3883/79-NL-HP(SC); MBB-R-3700/2273-R)
(ESA-CR(P)-1367) Avail: NTIS HC A13/MF A01

The design of a multiuse intersatellite laser range and range rate finder was investigated, and the expected performance of the instrumentation derived. Discussed are electrical and electro-optical design, signal and processing and electrical power distribution, structure and mechanical design, thermal control, an instrument performance analysis, test philosophy, and an instrument procurement plan. The instrument performs active acquisition and tracking of retro-reflective targets in a field of view of 2 deg X 2 deg, determines the range with a resolution of 0.01 m to 0.1 m, and gives the range rate with an accuracy of 10 micrometers/sec up to ranges of 250 km. For near field acquisition, 30 deg angular tracking is foreseen. The instrument incorporates four functional subunits. A CO2 laser superheterodyne transceiver for the range rate measurements, a laser diode range finder, a CCD acquistion and tracking unit, and a laser diode angular tracker. Author (ESA)

N81-12421# National Technical Information Service, Springfield, Va.
ATMOSPHERIC EFFECTS ON LASER BEAMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Aug. 1980
Brian Carrigan Aug. 1980 265 p Supersedes NTIS/PS-79/0981; NTIS/PS-78/0992
(PB80-814908; NTIS/PS-79/0981; NTIS/PS-78/0992) Avail: NTIS HC $30.00/MF $30.00 CSCL 20F

The compilation cites recent research on laser beam transmission through the atmosphere. Studies on molecular attenuation turbulence, thermal blooming atmospheric window flows, atmospheric composition, aerosols, infrared lasers, computerized simulation, and water vapor are included. The effects of attenuation on optical radar, optical communications, and infrared detection are covered. This updated bibliography contains 260 citations, 14 of which are new entries to the previous edition. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-12422*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MODIFIED SPIRAL WOUND RETAINING RING Patent Application
Ashby G. Lawson, inventor (to NASA) Filed 29 Aug. 1980 8 p
(NASA-Case-LAR-12361-1; US-Patent-Appl-SN-182880) Avail: NTIS HC A02/MF A01 CSCL 13E

A spiral wound retaining ring 10 with angled ends 214 and 216 is described. The ring is crimped 220 at the same angle as the ring ends to maintain a constant thickness dimension. The angling of the ends of the ring and crimp allow the ends to be positioned closer together while maintaining enough clearance to enable insertion and removal of the ring. By reducing the separation distance between the ends a stronger ring results since the double layer area of the ring is maximized. NASA

N81-12423# Milwaukee School of Engineering, Wis. Fluid Power Inst.
THE INVESTIGATION INTO HYDRAULIC GEAR PUMP EFFICIENCIES IN THE FIRST FEW HOURS OF THE PUMPS' LIVES AND A COMPARATIVE STUDY OF ACCELERATED LIFE TESTS METHODS ON HYDRAULIC FLUID POWER GEAR PUMPS, PART 3 Final Report, 29 Apr. - 30 Jun. 1979
31 Jul. 1980 55 p
(Contract DAAK70-77-C-0214)
(AD-A089848; P/N-50560-Pt-3) Avail: NTIS HC A04/MF A01 CSCL 13/11

This report summarizes the overall efficiency tests, durability and endurance tests at various oil contamination levels of the eighteen gear pumps previously tested in report parts 1 and 2 of this contract. GRA

N81-12424# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
A TERRAIN-VEHICLE MODEL FOR ANALYSIS OF STEERABILITY OF TRACKED VEHICLES
George Y. Baladi and Behzad Rohani Jun. 1980 15 p refs (DA Proj. 4A1-61102-AT-24)
(AD-A090360) Avail: NTIS HC A02/MF A01 CSCL 19/3

This paper discusses the design and development of high-mobility/agility tracked combat vehicles. These vehicles are tested for increased battlefield survivability through the avoidance, by high-speed and violent maneuver, of hits by high-velocity projectiles and missiles. The interrelationship between the terrain factors (such as soil type, soil shear strength and compressibility, etc.) and the vehicle's characteristics (weight, track length and width, location of center of gravity, velocity, etc.) during steering are studied. Idealized mathematical models of the terrain-vehicle interactions are constructed. The accuracy

and range of application of such models are determined from actual mobility experiments. GRA

N81-12425# Army Natick Research and Development Command, Mass. Clothing Equipment and Materials Engineering Lab.
THE PENETRATION OF NYLON BALLISTIC PANELS BY FRAGMENT SIMULATING PROJECTILES. PART 2: MECHANISM OF PENETRATION
Robert A. Prosser Aug. 1980 24 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A090341; NATICK/CEMEL-221; NATICK-TR-80/025)
Avail: NTIS HC A02/MF A01 CSCL 11/9

The purpose of this report is to present evidence supporting the thesis that the major mode of penetration of nylon ballistic panels by fragment simulating projectiles is a cutting, shearing mechanism. In particular: (a) shear forces required for yarn failure are usually less than tensile forces; (b) penetration is always at a slight angle, with the 90 deg edge of the FSP leading; (c) many yarn ends were found to terminate in a smooth surface (in a tensile break the filaments break at random places along the yarn); (d) penetration of the cloth in certain experimental situations occurred in a manner precluding tensile failure; (e) the force required for nylon or Kevlar yarn failure is less for a rectangular leading surface than it is for a chisel-shaped leading surface. GRA

N81-12426# Pratt and Whitney Aircraft, West Palm Beach, Fla.
ADVANCED INDUSTRIAL GAS TURBINE TECHOLOGY READINESS DEMONSTRATION Quarterly Technical Report, 1 Dec. 1979 - 29 Feb. 1980
20 Mar. 1980 11 p refs
(Contracts DE-AC05-76OR-05035; DE-AC05-76ET-15343)
(DOE/OR-05035/T1; FR-13019; QTPR-12) Avail: NTIS HC A02/MF A01

The component technology base required for improved industrial gas turbine conversion efficiency is discussed. Specific goals were to demonstrate the high-pressure compressor and turbine cooling technologies required to achieve industrial gas turbine efficiencies of 34 to 36% simple cycle and 45 to 48% in combined cycle operation while reducing the number of compressor and turbine parts 80% over state-of-the-art units. The approach involves combining aircraft turbine cooling and high pressure compressor technology with the simplicity and ruggedness required of industrial engines to achieve not only improved performance, but also increased durability and low initial cost. DOE

N81-12427# Avco Systems Div., Wilmington, Mass.
STATE-OF-THE-ART REVIEW OF FLYWHEEL BURST CONTAINMENT
Alan D. Sapowith, Emmet A. Witmer (MIT, Cambridge), Arthur L. Gurson, John A. McElman (Lowell Univ.), and Herbert Kaehler (AVCO Lycoming Div., Stratford, Conn.) 15 May 1980 109 p refs Prepared for California Univ., Livermore. Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15257; AVSD-0154-80-RR) Avail: NTIS HC A06/MF A01

Ballistic tests investigating local puncture show that glass composites are easier to contain than steel of equal kinetic energy by a factor of 2.5. Low cost simulation methods for obtaining empirical data required to correctly implement simplified strain energy analyses for containment ring design are suggested. Containment ring weight is markedly reduced if flywheel burst energy is captured as rotational energy as against translational energy. Kevlar is the lightest weight material for containing aircraft turbine bursts but does not offer substantial weight savings over steel for composite flywheel containment. A work plan is presented at several levels of effort leading to a final burst containment design. S.F.

N81-12428# Systems Science and Software, La Jolla, Calif.
NUMERICAL MODELING OF INLET MANIFOLD FLOWS IN INTERNAL COMBUSTION ENGINES Final Report
M. Chapman Aug. 1980 57 p refs
(Contract DE-AC04-80ET-15498)
(SSS-R-80-4620) Avail: NTIS HC A04/MF A01

A numerical procedure is developed to incorporate a two equation turbulence model into the DELTA algorithm (Dynamic Euelerian Lagrangian Triangular Algorithm). The turbulence model will allow more realistic simulations of inlet and exhaust flow in internal combustion engines and provide data on the usefulness of a two equation turbulence model in calculating flows in internal combustion engines. DOE

N81-12429# Ames Lab., Iowa.
PRESSURE VESSELS FOR COAL LIQUEFACTION: AN OVERVIEW
T. E. Scott 1980 37 p refs Presented at ASTM Symp. on the Appl. of 2 1/4 CR-1 mo Steel for Thick Wall Pressure Vessels, Denver, 18 May 1980
(Contract W-7405-eng-82)
(IS-M-282; CONF-8005108-1) Avail: NTIS HC A03/MF A01

The existing world economic and political climate has intensified the need for a domestic source of liquid fuels. With dwindling crude oil reserves the need for alternative sources of liquid fuels has become pressing. Coal derived liquids can be an important substitute for crude oil. A key component of process plants designed to liquify coals is the reactor. Coal liquefaction pressure vessels (reactors) for anticipated commercial operations are large by conventional standards. They must maintain a high level of reliability for lifetimes from 20 to 30 years while operating at temperatures near 425 C and while containing a variety of sulfurous species and hydrogen at pressures up to about 28 MPa. This paper attempts to emphasize the role of reactors in the coal liquefaction process and to point out potential life limiting aspects which must be considered in the design, construction, and operation of these large, thick walled pressure vessels. DOE

N81-12430# Bendix Corp., Kansas City, Mo.
EFFECTS OF XENON COVER GAS IN CO2 LASER WELDING
T. L. Hendrix Jul. 1980 27 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2442) Avail: NTIS HC A03/MF A01

Xenon gas used as an inert carbon dioxide laser welding atmosphere is proposed as a method to reduce weld spatter. Weld spatter is not only costly to remove, but has a detrimental effect on the performance of complex mechanisms. Xenon gas was introduced, using a 375 watt laser, under the same conditions used with argon gas which is the current inert atmosphere. Gas flow rate was the only variable used. Weld spatter was reduced but several trade-offs were encountered. There was a major decrease in weld penetration. The penetration ranged from 0.068 to 0.317 mm (0.0027 to 0.0125 inches). The penetration expected when argon is used is approximately 0.76 mm (0.03 inches). Also, a sooty deposit covered the weld bead and weld area when xenon was used. Author

N81-12431# Bendix Corp., Kansas City, Mo.
ULTRASONIC SEAM WELDING Final Report
G. S. Darner Jun. 1980 17 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2444) Avail: NTIS HC A02/MF A01

Ultrasonic seam welding was evaluated for making continuous seam welds on aluminum and copper foil conductors. A seam welding system was designed and fabricated, weldable material combinations were identified, and the process parameters for welding materials applicable to flat cable production were established. E.D.K.

N81-12432# Bendix Corp., Kansas City, Mo.
RESISTANCE SPOT WELDING OF Ti-6Al-4V ALLOY
D. M. Jarboe Jun. 1980 25 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2447) Avail: NTIS HC A02/MF A01

Experiments were performed to evaluate the effects of welding power, electrode force, electrode tip radius, and storage conditions on weld quality in order to establish guidelines for resistance spot welding of Ti-6Al-4V alloy. The tests revealed that increases in either weld power or electrode force results in higher strength welds. This trend was observed even when weld power was high enough to weld the electrodes to the test samples. Electrode tip radius had no effect on the resultant welds. Elapsed time between cleaning and welding had little effect on weld strength.

Results of this study indicate welding of this alloy is relatively insensitive to process variations. E.D.K.

N81-12433# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Turbomachinery Dept.

REVERSE FLOW, PRE-ROTATION AND UNSTEADY INLET FLOW IN CENTRIFUGAL PUMPS

Mete Sen, F. A. E. Breugelmans, and B. Schiavello (Worthington Spa.) Jul. 1979 34 p refs Presented at Natl. Eng. Lab, Silver Jubilee Conf. on Fluid Mech., East Kilbridge, England, 27-29 Nov. 1979 Submitted for publication

(VKI-PREPRINT-1979-15) Avail: NTIS HC A03/MF A01

The inlet flow field at partial deliveries in centrifugal pumps was studied. Pump design parameters which influence the reverse flow were investigated. To determine the governing parameters of the reverse flow, several impellers were designed, and details of flow conditions were examined in the suction pipe to determine the governing parameters of the reverse flow. It is shown that the principal factor affecting reverse flow is aerodynamic blade loading. Yaw angle measurements were done in the suction pipe to study the unsteady inlet flow. Author (ESA)

N81-12434# Technische Hogeschool, Delft (Netherlands). Lab. for Internal Combustion Engines.

THE CONSTANT VOLUME PROCESS IN RELATION TO THE GAS TURBINE AS EXEMPLIFIED BY THE KARAVODINE ENGINE Ph.D. Thesis

H. vanderMeulen Sep. 1979 248 p refs In DUTCH; ENGLISH summary

(WTHD-118) Avail: NTIS HC A11/MF A01

The constant volume gas turbine process is compared thermodynamically with other cycles applied to turbomachinery, on the basis of their relationship with cycles relevant to piston engines. The actual performance of a Holzwarth cycle gas turbine plant does not agree with experimental results. Losses realting to dead volume spaces and throttling in tanks and connecting pipes, gas exchange in the components, character and course of the combustion process, and energy conversion in the turbine explain the low performance. The Karavodine and Brayton cycles were compared using a test rig and a mathematical model. The experiments show good pulsating combustion with high efficiency and intensity and indicate that the Low performance is attributed to: (1) the instantaneous heat supply of the combustion chamber not being reproduced in the actual cycle; (2) the reduction of pressure rise because of the strong influence of the recirculating heat; and (3) throttling losses in the inlet valve. The Karavodine cycle is shown to be marginally superior in performance to the Brayton cycle at low pressure ratios. Author (ESA)

N81-12435# Fiat Research Center, Turin (Italy).

CURRENT AND FUTURE NEEDS FOR ENGINE ELECTRONIC CONTROL SENSORS

W. Mortara, R. Rinolfi, and E. Panizza 1979 9 p Presented at ISATA Working Group Meeting, Rome, 30 Apr. 1980

Avail: NTIS HC A02/MF A01

The engine electronic control is one of the most promising approaches for the satisfaction of emission and fuel economy constraints. A concise survey of the sensors currently used and foreseen to be used in the short term is presented. These components are mainly suitable for actual open-loop control strategies, the open issue in this area being a satisfactory trade-off between cost, reliability, and precision. The needs of automotive industry for sensors aimed at advanced closed-loop control strategies, is outlined. Author (ESA)

N81-12436# National Technical Information Service, Springfield, Va.

INERT GAS WELDING. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1977 - Aug. 1980

William E. Reed Sep. 1980 156 p Supersedes NTIS/PS-79/0996; NTIS/PS-78/0905

(PB80-815228; NTIS/PS-79/0996; NTIS/PS-78/0905) Avail: NTIS HC $30.00/MF $30.00 CSCL 13H

Reports are cited which deal with the development of techniques and procedures for inert gas welding and with the characteristics of the resulting welds. Process control, automation, and applications are also investigated. Metals welded include steel, titanium, aluminum, copper, and cast iron. GRA

N81-12437# National Technical Information Service, Springfield, Va.

INERT GAS WELDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1980

William E. Reed Aug. 1980 258 p Supersedes NTIS/PS-79/0995; NTIS/PS-78/0903

(PB80-815210; NTIS/PS-79/0995; NTIS/PS-78/0903) Avail: NTIS HC $30.00/MF $30.00 CSCL 13H

The reports cited deal with the development of techniques and procedures for inert gas welding and with the characteristics of the resulting welds. Process control, automation, nondestructive testing, and health hazards are also investigated. Metals welded include steel, titanium, aluminum, uranium, and refractory metals. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-12438 Saab-Scania, Linkoping (Sweden). Aerospace Div.

ON THE DECISION TO REPLACE A UNIT EARLY OR LATE: A GRAPHICAL SOLUTION

Bo Bergman 1979 7 p refs

(SAAB-FTK-0-79-19) Avail: NTIS HC A02

A graphical procedure for determining whether a unit should be replaced early or late, given that the unit cannot be replaced exactly at the optimum replacement time, is presented. The expected long run cost per time interval is used as the optimality criterion. An expression which considers the replacement cost, the additional cost suffered at failure, and a cumulative distribution function of the time to failure of the unit is minimized. The failure data analysis is based on the total time on test concept. Author (ESA)

N81-12439*# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

FAILURE DETECTION SYSTEM DESIGN METHODOLOGY Ph.D. Thesis

Edward Yik Chow Oct. 1980 234 p refs

(Grant NGL-22-009-124; Contract N00014-77-C-0224)

(NASA-CR-163792; LIDS-TH-1055) Avail: NTIS HC A11/MF A01 CSCL 14D

The design of a failure detection and identification system consists of designing a robust residual generation process and a high performance decision making process. The design of these two processes are examined separately. Residual generation is based on analytical redundancy. Redundancy relations that are insensitive to modelling errors and noise effects are important for designing robust residual generation processes. The characterization of the concept of analytical redundancy in terms of a generalized parity space provides a framework in which a systematic approach to the determination of robust redundancy relations are developed. The Bayesian approach is adopted for the design of high performance decision processes. The FDI decision problem is formulated as a Bayes sequential decision problem. Since the optimal decision rule is incomputable, a methodology for designing suboptimal rules is proposed. A numerical algorithm is developed to facilitate the design and performance evaluation of suboptimal rules. S.F.

N81-12440# Johns Hopkins Univ., Baltimore, Md. Dept. of Materials Science and Engineering.

ULTRASONIC AND ACOUSTIC EMISSION DETECTION OF FATIGUE DAMAGE Final Report, 1 Mar. 1976 - 31 May 1980

Sanford R. Buxbaum, Carl Lee Friant, Steven E. Fick, and Robert E. Green, Jr. Jul. 1980 120 p refs

(Contract F44620-76-C-0081; AF Proj. 2307)

(AD-A090799; AFOSR-80-1069TR) Avail: NTIS

HC A06/MF A01 CSCL 14/2

The primary purpose of the research was to optimize existing ultrasonic and acoustic emission techniques and to investigate new ones for early detection of fatigue damage in aluminum alloys used in aircraft construction. Ultrasonic attenuation measurements made simultaneously with fatigue tests on aluminum alloy bar, and sheet specimens gave warning of crack formation and imminent fracture much earlier than conventional ultrasonic methods. An ultrasonic pulse-echo system was used during fatigue cycling to record conventional A-scan waveforms as well as to monitor ultrasonic attenuation. In addition, acoustic emission signals were recorded simultaneously with the ultrasonic measurements on each test specimen using two different acoustic emission systems. The correlation of evidence of cumulative fatigue damage and acoustic emission data was approached by the use of long term true-rms averaging of the system output and frequency domain analysis of acoustic emission signals recorded at selected intervals throughout the test. The integrity of the data was verified by independent electronic testing of the instrumentation. Visual and in situ eddy current inspection, and optical and scanning electron microscopy were used to correlate acoustic emission and ultrasonic attenuation data to the physically deformed microstructure. GRA

N81-12441# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

AMARV HIGH RELIABILITY PIECE PART Final Report, Sep. 1976 - 28 May 1980

J. L. Holmgren May 1980 190 p

(Contract F04701-76-C-0100)

(AD-A090577; MDC-G8497; BMO-TR-80-12) Avail: NTIS HC A09/MF A01 CSCL 16/3

This paper provides an evaluation of the cost effectiveness of the implementation of SAMSO-STD-73-2C, with tailoring on the AMaRV program. It also contains historical background on the development of the control documents used for parts management and test. Conclusions drawn from results of the program, lessons learned, and recommendations for future programs are contained in the text. Appendices include parts screening and destructive physical analysis (DPA) summary data. GRA

N81-12442# Southwest Research Inst., San Antonio, Tex.

NONDESTRUCTIVE TESTING INFORMATION ANALYSIS CENTER, 1979 Annual Technical Report, 15 Feb. 1979 - 15 Feb. 1980

Richard T. Smith Sep. 1980 31 p

(Contract DLA900-79-C-1266)

(AD-A090718; SWRI-15-5607) Avail: NTIS HC A03/MF A01 CSCL 14/2

During the reporting period, NTIAC's computerized data file grew to 17,546 records. The NTIAC Newsletter was distributed to over 4000 recipients. Ninety inquiries (technical, bibliographic, and general) were responded to. Publications included the NTIAC Handbook and a state-of-the-art survey on Barkhausen NDE. Drafts of a critical review on magnetic leakage methods and a state-of-the-art survey on optical technologies have been prepared. Also, a critical review on accreditation and certification has been drafted, and two state-of-the-art surveys on composite materials were initiated. GRA

N81-12443# Army Armament Research and Development Command, Dover, N. J. Energetic Materials Div.

NONDESTRUCTIVE TESTING OF ARMAMENT-SYSTEM COMPONENTS BY MEANS OF NEUTRON DIFFRACTION

Henry J. Prask, Chang S. Choi, and Samuel F. Trevino Jun. 1980 15 p refs

(AD-A090433) Avail: NTIS HC A02/MF A01 CSCL 14/2

In recent years, increasing emphasis has been placed on nondestructive testing (NDT) techniques for quality control in a large variety of applications. Progress in this area has considerable importance for DOD because of the increasing complexity and cost of armament systems and the inherent limitations of quality control by means of traditional, destructive test methods. This is dramatically illustrated by the on-going, multi-billion dollar DA plant modernization project within which incorporation of state-of-the art NDT methods is an essential part. Various NDT techniques in which X-rays are employed (e.g., radiography, diffraction) are already well established as quality control methods. The use of neutrons which complements and parallels X-ray techniques has been except for neutron radiography -- neglected for NDT, primarily because their use is generally limited to a laboratory environment (e.g., a research reactor). Despite this current limitation, there has been a renewed interest in utilizing neutron scattering for certain technological applications. GRA

N81-12444# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost.

TEST REPORT OF THE PROOF PRESSURE AND LEAK TESTS, PERFORMED ON THE VIEWPORT ADAPTOR ASSEMBLY

F. H. Naber 19 Feb. 1979 5 p

(FOK-RV-79-24) Avail: NTIS HC A02/MF A01

The results of pressure tests at 1.5 bar and leak tests at 1 BAR performed on three viewport adapters are presented. The deflections of one of the viewports during the pressure tests are also reported. The measured leak rates vary from 3.3 to 4.6 mg/h. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-12445*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DEPLOYABLE AND ERECTABLE CONCEPTS FOR LARGE SPACECRAFT

H. G. Bush, W. L. Heard, Jr., J. E. Walz, and J. J. Rehder Oct. 1980 24 p refs Presented at the 39th Ann. Conf. of the Soc. of Allied Weight Engr., Inc., St. Louis, 12-14 May 1980 (NASA-TM-81904) Avail: NTIS HC A02/MF A01 CSCL 20K

Computerized structural sizing techniques were used to determine structural proportions of minimum mass tetrahedral truss platforms designed for low Earth and geosynchronous orbit. Optimum (minimum mass) deployable and erectable, hexagonal shaped spacecraft are sized to satisfy multiple design requirements and constraints. Strut dimensions characterizing minimum mass designs are found to be significantly more slender than those conventionally used for structural applications. Comparison studies show that mass characteristics of deployable and erectable platforms are approximately equal and that the shuttle flights required by deployable trusses become excessive above certain critical stiffness values. Recent investigations of eractable strut assembly are reviewed. Initial erectable structure assembly experiments show that a pair of astronauts can achieve EVA assembly times of 2-5 min/strut and studies indicate that an automated assembler can achieve times of less than 1 min/strut for around the clock operation. A.R.H.

N81-12446*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

STABILITY OF LARGE HORIZONTAL-AXIS AXISYMMETRIC WIND TURBINES Ph.D. Thesis - Delaware Univ.

M. S. Hirschbein and M. I. Young (Delaware Univ., Newark) 1980 37 p refs Presented at 3d Miami Conf. on Alternative Energy Sources, Miami, 15-17 Dec. 1980

(NASA-TM-81623; E-633) Avail: NTIS HC A03/MF A01 CSCL 20K

The stability of large horizontal axis, axi-symmetric, power producing wind turbines was examined. The analytical model used included the dynamic coupling of the rotor, tower and power generating system. The aerodynamic loading was derived from blade element theory. Each rotor blade was permitted tow principal elastic bending degrees of freedom, one degree of freedom in torsion and controlled pitch as a rigid body. The rotor hub was mounted in a rigid nacelle which may yaw freely or in a controlled manner. The tower can bend in two principal directions and may twist. Also, the rotor speed can vary and may induce perturbation reactions within the power generating

equipment. Stability was determined by the eigenvalues of a set of linearized constant coefficient differential equations. All results presented are based on a 3 bladed, 300 ft. diameter, 2.5 megawatt wind turbine. Some of the parameters varied were; wind speed, rotor speed structural stiffness and damping, the effective stiffness and damping of the power generating system and the principal bending directions of the rotor blades. Unstable or weakly stable behavior can be caused by aerodynamic forces due to motion of the rotor blades and tower in the plane of rotation or by mechanical coupling between the rotor system and the tower. Author

N81-12447*# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Civil Engineering.
PRELIMINARY STUDY ON THE POTENTIAL USEFULNESS OF ARRAY PROCESSOR TECHNIQUES FOR STRUCTURAL SYNTHESIS Final Report
Larry J. Feeser 5 Dec. 1980 153 p refs
(Contract NsG-1636)
(NASA-CR-163801) Avail: NTIS HC A12/MF A01 CSCL 20K

The effects of the use of array processor techniques within the structural analyzer program, SPAR, are simulated in order to evaluate the potential analysis speedups which may result. In particular the connection of a Floating Point System AP120 processor to the PRIME computer is discussed. Measurements of execution, input/output, and data transfer times are given. Using these data estimates are made as to the relative speedups that can be executed in a more complete implementation on an array processor maxi-mini computer system. M.G.

N81-12448*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DYNAMIC RESPONSE OF A FORWARD-SWEPT-WING MODEL AT ANGLES OF ATTACK UP TO 15 DEG AT A MACH NUMBER OF 0.8
Robert V. Doggett, Jr. and Rodney H. Ricketts Nov. 1980 31 p refs
(NASA-TM-81863; L-13872) Avail: NTIS HC A03/MF A01 CSCL 20K

Root mean square (rms) bending moments for a dynamically scaled, aeroelastic wing of a proposed forward swept wing, flight demonstrator airplane are presented for angles of attack up to 15 deg at a Mach number of 0.8 The 0.6 size semispan model had a leading edge forward sweep of 44 deg and was constructed of composite material. In addition to broad band responses, individual rms responses and total damping ratios are presented for the first two natural modes. The results show that the rms respnse increases with angle of attack and has a peak value at an angle of attack near 13 deg. In general, the response was characteristic of buffeting and similar to results often observed for aft swept wings. At an angle of attack near 13 deg, however, the response had characteristics associated with approaching a dynamic instability, although no instability was observed over the range of parameters investigated. Author

N81-12449 National Aerospace Lab., Tokyo (Japan).
A STATISTICAL CONSIDERATION OF MINER'S RULE
Toshiyuki Shimokawa and Sakae Tanaka May 1980 13 p refs
(NAL-TR-611T) Avail: NTIS HC A02/MF A01

Miner's rule regarding the fatigue behavior of materials is discussed from a statistical standpoint. The conditions required for both the parameters of the log normal and Weibull distribution functions of fatigue life and the cumulative damage rule to satisfy statistical Miner's rule were derived. For the case when the conditions obtained were not satisfied the reliability of the population and the mean cumulative cycle ratio to failure were considered for two step fatigue tests, and calculation examples are given. Fatigue life scatter has a fairly large effect on the mean cumulative cycle ratio to failure. Author

N81-12450# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
VISCOPLASTIC AND CREEP CRACK GROWTH ANALYSIS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Terry S. Hinnerichs Jun. 1980 200 p refs
(AF Proj. 2307)
(AD-A090344; AFIT/DS/AA/80-2) Avail: NTIS HC A09/MF A01 CSCL 11/6

Creep crack growth in a nickel base alloy at elevated temperatures was analyzed through a hybrid experimental-numerical (HEN) procedure. This HEN procedure consisted of simultaneous use of creep crack growth test displacement data from center cracked plate specimens of IN-100 at 1350 F and a theoretical finite element model of the test specimen. A two dimensional (constant strain triangular) finite element program was developed which accounts for both nonlinear viscoplactic material behavior and changing boundary conditions due to crack growth. Three viscoplastic material models -- (1) Malvern Flow Law, (2) Norton's Creep Law, and (3) Bodner-Partom Flow Law -- were incorporated into the program. These time dependent material models were numerically integrated through time by a linear Euler extrapolation technique. A variable time step algorithm was included that maximized time step size during the analysis while maintaining good accuracy. This program was used as the plane stress theoretical model for the HEN procedure to analyze sustained load creep crack growth. GRA

N81-12451# Nielsen Engineering and Research, Inc., Mountain View, Calif.
AEROELASTIC OPTIMIZATION WITH MULTIPLE CONSTRAINTS Final Scientific Report, 15 Jul. 1978 - 14 Nov. 1979
S. C. McIntosh, Jr. Sep. 1980 58 p refs
(Contract F49620-78-C-0105; AF Proj. 2307)
(AD-A090775; NEAR-TR-228; AFOSR-80-1070TR) Avail: NTIS HC A04/MF A01 CSCL 01/1

Two optimality-criterion algorithms for treating problems with multiple behavioral constraints are described. The first employs slack variables to recast inequality constraints as equality constraints, so that the optimization procedure can be based on an earlier one developed for multiple equality constraints. The second is based on earlier work that uses Gauss-Seidel iteration to identify the active constraints by identifying the set of positive Lagrange multipliers. Both methods are applied to some simple test cases with two design variables, and then the slack-variable algorithm is applied to optimize the weight of a biconvex sandwich wing under various combinations of flutter and frequency constraint. The behavior of this algorithm is discussed and recommendations are given for future work. GRA

N81-12452# Southwest Research Inst., San Antonio, Tex.
FATIGUE MICROCRACK BEHAVIOR UNDER THE INFLUENCE OF SURFACE RESIDUAL STRESSES Interim Report, 1 Aug. 1979 - 31 Jul. 1980
John E. Hack and Gerald R. Leverant 1 Oct. 1980 46 p refs
(Contract N00014-78-C-0674; NR Proj. 031-812)
(AD-A090561; SwRI-02-5382) Avail: NTIS HC A03/MF A01 CSCL 11/6

Direct observations of the surface crack opening displacement (SCOD) of surface and corner cracks were made on samples of Ti-6Al-4V under both cyclic and static loading conditions. The observations were conducted in a specially designed loading stage in situ in a scanning electron microscope. Cracks from 7-1300 microns have been studied by this technique. Results show that surface residual stresses can significantly affect crack opening behavior, thus crack growth behavior, even when the crack has grown well beyond the zone of residual stress. Concurrent with experimental efforts, an analytical approach has been developed and used to predict SCOD for Mode I surface microcracks based on crack geometry. Correlation with independent results for macrocracks and values for microcracks measured in this program are excellent. In addition, an existing computer program has been successfully used to predict SCOD of corner cracks in the absence and presence of an imposed compressive residual stress field. GRA

N81-12453# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
FATIGUE CRACK PROPAGATION AND CORROSION FATIGUE OF AF 1410 STEEL Technical Report, May 1976 - May 1978
S. D. Antolovich Wright-Patterson AFB, Ohio AFML Jan. 1980 121 p refs
(Contract F33615-76-C-5227; AF Proj. 7351)

(AD-A090497; AFML-TR-79-4209) Avail: NTIS HC A06/MF A01 CSCL 11/6

The fatigue crack propagation (FCP) and corrosion fatigue (CF) behavior of AF 1410 steel was studied, primarily in the 950 F/5h aged condition. In addition some LCF tests were carried out to investigate fundamental mechanisms. It was shown that the FCP behavior of this steel was similar to many other alloy steels and could be described by conventional models. The material was sensitive to environmental effects in lab air at low frequencies and stress intensities. GRA

N81-12454# *Lehigh Univ., Bethlehem, Pa. Inst. of Fracture* and Solid Mechanics.

TWO-DIMENSIONAL TRANSIENT HYGROTHERMAL STRESSES IN BODIES WITH CIRCULAR CAVITIES: MOISTURE AND TEMPERATURE COUPLING EFFECTS Final Report

G. C. Sih and Akinori Ogawa (National Aerospace Lab., Tokyo) Aug. 1980 75 p refs

(Contract DAAG46-79-C-0049)

(AD-A090626; AMMRC-TR-80-41) Avail: NTIS HC A04/MF A01 CSCL 20/11

When moisture and/or temperature are suddenly changed on the boundary of a solid, stresses and strains are introduced and they can be further aggravated by the presence of stress raisers such as voids or cavities. A time dependent finite element procedure is developed for solving the hygrothermal stresses around a circular cavity in a finite plate. Numerical results are displayed graphically for the T300/5208 graphite fiber-reinforced epoxy resin material. The size of the hole relative to the plate is varied for three different cases such that the interaction of moisture and temperature is investigated in conjunction with changes in the solid geometry. Possible failure sites are also examined by application of the strain energy density criterion. These locations are determined from the stationary values of the strain energy factor. The hygrothermal influence tends to move the failure site away from the cavity while the mechanical load gives the opposite effect. The proportion of the energy stored by hygrothermal and mechanical disturbances is investigated. GRA

N81-12455# *Lehigh Univ., Bethlehem, Pa. Inst. of Fracture* and Solid Mechanics.

TRANSIENT HYDROTHERMAL AND MECHANICAL STRESS INTENSITIES AROUND ELLIPTICAL CAVITIES Final Report

G. C. Sih and Akinori Ogawa (National Aerospace Lab., Tokyo) Aug. 1980 54 p refs

(Contract DAAG46-79-C-0049)

(AD-A090625; AMMRC-TR-80-42) Avail: NTIS HC A04/MF A01 CSCL 20/11

The transient hygrothermal stresses are determined by assuming that heat and moisture are coupled. A system of coupled diffusion equations is solved by a finite element scheme allowing for time-dependent changes in the moisture and/or temperature on the surfaces of the T300/5208 epoxy resin for the graphite/epoxy fiber-reinforced composite. The time dependent portion of the problem was solved by means of Laplace transformation. Particular emphases are given to the evaluation of transient stresses around a mechanical imperfection in the form of a narrow ellipse. Numerical results are displayed graphically for three different values of the semi-minor to semi-major axis ratio. A stress intensity factor parameter commonly used in fracture mechanics is defined for a narrow ellipse and calculated to investigate the influence of stresses induced by hygrothermal and mechanical disturbances. The radius of curvature of the elliptical cavity can significantly affect the combined stress intensity near the cavity ends. The maximum stress intensities occur at different times depending on the cavity geometry and proportion of the hygrothermal and mechanical loading. These results could shed light on composite failure under conditions where heat and moisture play a role. GRA

N81-12456# Army Armament Research and Development Command, Watervliet, N. Y. Large Caliber Weapon Systems Lab.

BENEFITS OF OVERLOAD FOR FATIGUE CRACKING AT A NOTCH

J. H. Underwood and J. A. Kapp May 1980 29 p refs Presented at the 13th Natl. Symp. on Fracture, Philadelphia, 9-12 Jun. 1980

(AD-A090698; AD-E440086; ARLCB-TR-80011) Avail: NTIS HC A03/MF A01 CSCL 20/11

Tests are described which measure the effect of compression overload on fatigue crack initiation and growth from a 0.1 mm radius notch in alloy steel Klc specimens. Other tests are described which measure the effect of tension overload on fatigue crack initiation and growth from a 3.4 mm root radius notch in similar specimens. The effect of overload on the number of cycles required for crack growth is described for both types of tests in relation to a residual stress model. GRA

N81-12457# *Aberdeen Proving Ground, Md. Material Testing* Directorate.

ELECTRON MICROSCOPY FOR FRACTURE MODE IDENTIFICATION

Charles R. Klarich, R. L. Huddleston, and M. J. Drabo Jun. 1980 15 p refs

(AD-A090412) Avail: NTIS HC A02/MF A01 CSCL 14/2

Metallurgical failure analysis represents a technology which combines the knowledge of many scientific and engineering disciplines. During these times of increasing product liability litigation, interest in failure analysis has intensified. The failure analyst is asked to identify the cause of catastrophic failures in many different materials. During past years at the proving ground, the list of materiel evaluated includes such diverse items as a cargo truck firewall and 175 mm gun tubes. The disciplines required include, metallography, chemical analysis, light and electron microscopy, stress analysis, and the measurement of mechanical properties. Effective failure analysis depends on a combination of factors; these include the assessment of prior manufacturing and service history, a knowledge of materials and available test methodology and finally, how these factors interrelate with the applied loads and design intent (1) Conventional failure analysis begins with a visual examination of the item to evaluate the material response to fracture. The analyst uses all the disciplines outlined above to focus the investigation on the cause of failure. A powerful tool in the analysis is the Scanning Electron Microscope (SEM) and the discipline called fractography. GRA

N81-12458# Bell Aerospace Co., Buffalo, N. Y.

OPTIM III: A NASTRAN COMPATIBLE LARGE SCALE AUTOMATED MINIMUM WEIGHT DESIGN PROBLEM. USERS AND PROGRAMMERS MANUAL Final Report, Jun. 1977 - Dec. 1979

B. J. Dale, J. Padlog, and Richard D. Thom Feb. 1980 192 p refs

(Contract F33615-77-C-3032; AF Proj. 2307)

(AD-A090334; AFWAL-TR-80-3007) Avail: NTIS HC A09/MF A01 CSCL 13/13

The weight optimization computer program OPTIM II was extended to a new version, OPTIM III, which is compatible with the input format of the NASTRAN finite element computer program. All features of the original program were retained including the use of optimality criteria to generate a highly efficient iterative optimization procedure with convergence characteristics independent of problem size. GRA

N81-12459# Oak Ridge National Lab., Tenn.

TESTING PROGRAM FOR DETERMINING THE MECHANICAL PROPERTIES OF CONCRETE TO TEMPERATURES OF 621 C

C. B. Oland, D. J. Naus, and G. C. Robinson 1980 27 p refs Presented at the Am. Concrete Inst. Fall Conv., San Juan, Puerto Rico, 24 Sep. 1980

(Contract W-7405-eng-26)

(CONF-800969-1) Avail: NTIS HC A03/MF A01

Concrete temperatures in a Liquid Metal Fast Breeder Reactor (LMFBR) in excess of normal code limits can result from postulated large sodium spills in equipment cells. Elevated temperature concrete property data which may have application for providing a basis for the design and evaluation of such postulated accident conditions is limited. Data thus needed to be developed commensurate with LMFBR plant applications for critical physical and mechanical concrete properties under prototypic thermal accident conditions. A test program was conducted to define

the variations in physical and mechanical properties of a limestone aggregate concrete and a light weight insulating concrete exposed to elevated temperatures. Five test series were conducted: unconfined compression, shear, rebar bond, sustained loading (creep), and thermal properties. Testing procedures for determining the mechanical properties of concrete from ambient to 621 C (1150 F) are described. DOE

N81-12460# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.

GRID AND CQUAD: TWO PREPROCESSING CODES FOR NASTRAN

Arnold T. Futterer Aug. 1980 15 p refs

(DA Proj. 1L1-62618-AH-80)

(AD-A090664; AD-E430509; ARBRL-MR-03050) Avail: NTIS HC A02/MF A01 CSCL 13/13

Two preprocessing codes were designed to generate a grid and CQUAD2 elements for rectangular plate problems to be analyzed by NASTRAN. The GRID program generates a two or three dimensional grid with uniform spacing as specified by the user, i.e., A, B, C is the uniform spacing in the X, Y, Z directions, respectively. Any leftover uneven increment is placed in the last interval. CQUAD generates CQUAD2 elements to fill the two dimensional grids generated by GRID. Both programs punch out the appropriate cards needed for input. GRA

N81-12461# Argonne National Lab., Ill. Reactor Analysis and Safety Div.

LAGRANGIAN THREE-DIMENSIONAL FINITE-ELEMENT FORMULATION FOR THE NONLINEAR FLUID-STRUCTURAL RESPONSE OF REACTOR COMPONENTS

R. F. Kulak and C. Fiala Mar. 1980 47 p refs

(Contract W-31-109-eng-38)

(ANL-80-26) Avail: NTIS HC A03/MF A01

The formulations used in the NEPTUNE code are presented. Particular attention is given to the formulation of a three dimensional hexahedral element for simulating the behavior of either fluid or solid continua. An algorithm is presented for integrating the elastoplastic constitutive equations. It uses a subincrementation procedure and a yield surface return scheme so that the end of step stress state lies on the yield surface. R.C.T.

N81-12462# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

A MULTIPROCESSOR SYSTEM FOR CREEP FATIGUE TEST MONITORING

M. Monici and A. Stefanini Nov. 1979 12 p refs Presented at Intern. Conf. on Meas. Systems and Distributed Process., Pavia, Italy, 15-16 Oct. 1979

(CISE-1531) Avail: NTIS HC A02/MF A01

A data acquisition and operation monitoring system of the equipment for creep fatigue and environmental fatigue tests was designed. The system is based on a multiprocessor hierarchical structure, built up by single processor functional units mutually linked via serial channels. It was designed for fault detection and is to work under conditions of partial degradation. Author (ESA)

N81-12463# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Structures and Dynamics Div.

APPLICATION OF FRACTURE MECHANICS TO US AIR FORCE AIRCRAFT STRUCTURAL INTEGRITY REQUIREMENTS

R. M. Bader and J. W. Lincoln Paris Association Aeronautique et Astronautique de France 1979 33 p refs

(AAAF-NT-79-25; ISBN-2-7170-0573-0) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

The development of the structural maintenance plan for an older aircraft is discussed as well as for a new aircraft where damage tolerance requirements are an integral part of the development contract. Flaw sizes used for the calculation of the inspection intervals to protect the safety of the force are based on inspection capabilities and damage that might exist in the structure from manufacturing or rework processes. The durability of economic life assessment is, however, based on the average of typical quality achieved through the manufacturing process. The relation between the damage tolerance assessment which leads to the force structural maintenance plan and the durability assessment is discussed. Current research efforts underway to alleviate these difficulties are listed with recommendations. Author (ESA)

N81-12464# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).

CURRENT DEVELOPMENTS IN AIRCRAFT FATIGUE EVALUATION PROCEDURES

O. Buxaum and D. Schutz Paris Association Aeronautique et Astronautique de France 1979 34 p refs Presented at 14th Intern. AAAF Aeron. Congr. on New Develop. in Struct. and Mater., Paris, 6-8 Jun. 1979

(AAAF-NT-79-33; ISBN-2-7170-0581-I) Avail: NTIS HC A03/MF A01; CEDOCAR, Paris FF 34 (France and EEC) FF 39 (others)

Current developments in the field of aircraft fatigue evaluation are reviewed including the description of loads for fatigue evaluation, the damage tolerance concept, concepts for the prediction of fatigue life, fatigue life improvement during production, load transfer in mechanical joints, and the characteristics of the fiber reinforced materials. There is not yet a satisfactory theory to explain the fatigue mechanism. Fatigue testing is the most important tool in defining the life of aircraft structures. Author (ESA)

N81-12465# Saab-Scania, Goteberg (Sweden).

BUCKLING OF SANDWICH PANELS SUBJECTED TO AXIAL COMPRESSION, SHEAR FORCES AND LATERAL PRESSURE. PART 2: ANALYSIS

Sven Erik Larsson, Harald Bengtsson, and Sten Oeberg 1980 79 p refs

(SAAB-TN-AE-72-Pt-2) Avail: NTIS HC A05/MF A01

A comprehensive study on analysis and testing of sandwich panels subjected to combined in-plane and normal loading is presented. The investigation is related to bonded panels with aluminum skins and aluminum honeycomb core. The purpose was to develop and verify analysis methods applied in the stress and strength analysis of honeycomb panels used in aircraft primary structures. A significant part of the work was performed as development work for the Swedish Air Force Viggen aircraft. It is concluded that the calculation method derived gives satisfactory results in estimating ultimate panel loads. Author (ESA)

N81-12466# Societe Nationale Industrielle Aerospatiale, Suresnes (France). Lab. Central.

EXPERIMENTAL METHODOLOGY. APPLICATION OF CONCEPTS FROM MECHANICS TO MATERIAL RUPTURE STUDIES [METHODOLOGIE EXPERIMENTALE APPLICATION DES CONCEPTS DE MECANIQUE DE LA RUPTURE AUX METAUX]

J. Odorico Paris 12 Jun. 1980 20 p In FRENCH Presented at 14th AAAF Intern. Aeron. Congr., Paris, 6-8 Jun. 1979

(SNIAS-801-551-104) Avail: NTIS HC A02/MF A01

Methods to improve the definition and choice of material grades and heat treatment were studied. Emphasis was given to the effects of simple and stress corrosion phenomena. Parameters associated with the creation of defects, their propagation and the rupture characteristics of the materials concerned were studied to obtain a basis for predicting behavior under real conditions. The stress intensity factor is defined and details given on its use. Results obtained for various aluminum alloys are presented. Author (ESA)

N81-12467# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

MIXED VARIATIONAL PRINCIPLES FOR STATIC PROBLEMS COUPLING THESE PRINCIPLES WITH THE DISPLACEMENT PRINCIPLE Ph.D Thesis - Paris Univ.

Sophia Chryssafi 1980 85 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-664)

(ONERA-NT-1980-2; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The applications of variational principles such as the Hellinger-Reissner modified principle and the Fraeijs de Veubeke principle to the study of stress concentration of structures with

large stress gradients are analyzed. A coupling method of mixed variational principles with the displacement method is proposed. It consists of applying a mixed variational principle in that part of a structure susceptible to large stress concentration, and the displacement method in the complementary part. The finite elements used are examined. The results of numerical examples are given. Author (ESA)

N81-12468# Royal Aircraft Establishment, Farnborough (England).
MOBILITY MEASUREMENTS ON A BEAM AND A DYNAMIC ABSORBER
Susan M. Damms London HMSO May 1980 27 p refs (RAE-TM-Aero-1842; BR74521) Avail: NTIS HC A03/MF A01

The measurement of the responses of two structures to certain input forces is described. The measurements were performed on the two separate structures to predict the results for a structure formed by connecting them together. One of the structures chosen was a beam and the other was designed to behave as a dynamic absorber when attached to the beam. Confidence was given to the measurements by comparing the results with theory as far as possible. For a test case involving low model density and simple force excitation, accurate mobility data are obtained. Author (ESA)

N81-12469# Royal Aircraft Establishment, Farnborough (England).
GREEN'S FUNCTION IN FRACTURE MECHANICS
D. J. Cartwright (Southampton Univ., England) and D. P. Rooke London HMSO Mar. 1980 39 p refs Presented at Conf. on Fracture Mech.: Current Status, Future Prospects, Cambridge, England, 16 Mar. 1979
(RAE-TR-80035; RAE-Mat-394; BR74344) Avail: NTIS HC A03/MF A01

The use of Green's functions in the determination of stress intensity factors is described and applied to the solution of problems in fracture mechanics. Methods of obtaining further Green's functions from existing ones are presented. It is shown that several commonly used simple methods of determining stress intensity factors can be expressed in terms of approximate Green's functions. Many important Green's functions are presented and some of these are used to solve several problems of practical importance to the aerospace industry such as cracks in stiffened sheets and cracks in pin loaded lug joints. Author (ESA)

N81-12470# Royal Aircraft Establishment, Farnborough (England).
THE NORMAL MODES OF BEAM-LIKE STRUCTURES BY A LANCZOS-STODOLA METHOD
L. T. Niblett London HMSO May 1980 14 p refs
(RAE-TR-80058; RAE-Struct-BF/B/0832; BR74671) Avail: NTIS HC A02/MF A01

A method of finding the flexural and torsional normal modes of structures which have straight stiffness axes and which are mounted as cantilevers is given. The Lanczos method of minimized iterations is used to obtain intermediate modes using integro-differential equations and the mass and stiffness distributions. The inertia matrix appropriate to the intermediate modes is tridiagonal and the stiffness matrix is unit. The dominant eignevalues and vectors of the inertia matrix give good approximations to the graver normal models. Results of test calculations using a computer program which also allows for the presence of discrete masses are given. Author (ESA)

N81-12471# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
INVESTIGATION OF MINIMUM CHARACTERISTIC LENGTH OF AN AREA OF SOLAR CELLS LOADED BY A SOUND FIELD
J. J. Wijker 19 Dec. 1979 16 p refs
(FOK-RV-79-18) Avail: NTIS HC A02/MF A01

Acoustic tests were performed on a solar wing of the European Communications Satellite solar array in an acoustic test chamber. The minimum characteristic length of the area exposed to the sound field and the solar cell degradation were investigated. It is concluded that if the frequency is below the critical frequency of the panel of about 602 Hz, the acoustic loads can be neglected: It is also shown that to represent the mechanical load environment on a particular area of solar cells, a rectangular area must be at least 0.21 m x 0.16 m.
Author (ESA)

N81-12472# British Aerospace Aircraft Group, Bristol (England).
SPACECRAFT STRUCTURAL ACOUSTIC STUDIES. INVESTIGATION, INTERPRETATION, AND SIMULATION OF THE EFFECTS OF CONFIGURATION FEATURES ON NOISE. INDUCED STRUCTURAL VIBRATION AND SOUND TRANSMISSION CHARACTERISTICS Final Report
R. J. Cummins and I. Gray Paris ESA May 1980 181 p refs
(Contract ESA-3764/78-NL-PD)
(BAe-ESA/B44/40013; ESA-CR(P)-1366) Avail: NTIS HC A09/MF A01

Broad band acoustic excitation tests were performed on various satellite structural configurations. Limited tests were also performed for narrow band acoustic noise excitation and for random and sine sweep mechanical excitation. Test data were used to assess prediction methods, in particular a statistical energy analysis method implemented in a computer program GENSTEP (General Statistical Energy Program) which predicts the response of a structural configuration including acoustics cavities. The GENSTEP program was updated and the prediction technique was investigated. The modal density of honeycomb panels was studied and an empirical technique devised to evaluate sound transmission of a stiffened cylinder at low frequencies. Theory describing the power input from a mechanical source is evaluated. The response to broad band excitation is compared to the predicted responses for two configurations. There is good agreement between the values. Author (ESA)

N81-12473# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FRACTOGRAPHY: A SURVEY
G. F. J. A. vanGestel 26 Jun. 1980 28 p refs In DUTCH; ENGLISH summary Presented at Symp. on Breukverschijnselen in Mater., Delft, 17 Nov. 1977
(NLR-MP-77026-U) Avail: NTIS HC A03/MF A01

An overview is presented of the various aspects involved in a fracture surface investigation, starting with a definition of fractography and why it is done. The equipment needed is discussed, including stereo-microscopes, optical microscopes, transmission and scanning electron microscopes, and micro-analysis equipment. Guidelines for handling of fracture surfaces and specimen preparation are given. The characteristics of various types of fracture are discussed, including overload failure, fatigue, stress corrosion, hydrogen embrittlement, and creep.
Author (ESA)

N81-12474# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
MANUAL FOR THE AGARD-COORDINATED CORROSION FATIGUE COOPERATIVE TESTING PROGRAM (CFCTP)
R. J. H. Wanhill and J. J. DeLuccia 1 May 1979 80 p
(NLR-MP-79017-U) Avail: NTIS HC A04/MF A01

Specifications for corrosion fatigue tests for aerospace structural materials are presented. Detailed specifications for specimens, clamping in, electrohydraulic machines, cold box, pre-exposure chambers, corrosion fatigue salt spray cabinet, specimen storage and cleaning, test procedure, reporting, and flight simulation testing are given. Author (ESA)

N81-12475# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
APPLICATION OF FRACTURE MECHANICS TO BUILT-UP STRUCTURES
H. Vlieger Nov. 1979 116 p refs
(NLR-MP-79044-U) Avail: NTIS HC A06/MF A01

The interaction of reinforced and cracked elements in built-up panels of sheets and stringers, and discussions of residual strength and of fatigue crack propagation are presented. The sheet-stiffener interaction problem, modeling of rivet connections, partial failures of stiffeners, and debonding of adhesive bonded panels are reviewed. Available computer programs are referenced. Residual strength of flat panels loaded in uniaxial tension, of curved panels subject to cabin pressure loads, and applicability

of fracture mechanics principles to real structures are summarized. The fatigue crack propagation curve, damage development assumptions, and integrally stiffened panels are covered. Example problems with real structures are included. Author (ESA)

N81-12476# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
TWO SIMPLE METHODS FOR DEFORMATION DEMONSTRATION AND MEASUREMENT
P. J. Sevenhuijsen Jan. 1980 14 p ref Presented at 15th Ann. Brit. Soc. for Strain Meas. Conf. on Pract. Strain Meas., Bristol, Engl., 3-6 Sep. 1979
(NLR-MP-80002-U) Avail: NTIS HC A02/MF A01

A photographic paper with a polyethylene coated paper base is used to produce test specimens provided with highly deformable high constrast grids. It is shown that ordinary objects like drinking straws and a film camera can be used for the study of buckling phenomenon. Both methods are simple and can be used for deformation demonstration and measurement. Author (ESA)

N81-12477# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
FLIGHT SIMULATION ENVIRONMENTAL FATIGUE CRACK PROPAGATION IN 2024-T3 AND 7475-T761 ALUMINUM
R. J. H. Wanhill Jan. 1980 10 p refs Presented at 12th ICAS Congr., Munich, 12-17 Oct. 1980
(NLR-MP-80003-U) Avail: NTIS HC A02/MF A01

Flight simulation fatigue crack propagation tests on 2024-T3 and 7475-T761 aluminum alloy sheet were carried out using a gust spectrum representative of the load history of an under wing skin in a transport aircraft. The investigation included tests at several design stress levels and in environments of laboratory air and air plus water spray. The results are discussed with respect to the choice of structural concepts using 7475 alloy and evaluation of the fatigue properties of such concepts.
Author (ESA)

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N81-12478*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
CANADIAN CROP CALENDARS IN SUPPORT OF THE EARLY WARNING PROJECT
M. H. Trenchard and T. Hodges, Principal Investigators Aug. 1980 151 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10001; NASA-CR-163558; SR-LO-00475; LEMSCO-14676; JSC-16376) Avail: NTIS HC A08/MF A01 CSCL 02C

The Canadian crop calendars for LACIE are presented. Long term monthly averages of daily maximum and daily minimum temperatures for subregions of provinces were used to simulate normal daily maximum and minimum temperatures. The Robertson (1968) spring wheat and Williams (1974) spring barley phenology models were run using the simulated daily temperatures and daylengths for appropriate latitudes. Simulated daily temperatures and phenology model outputs for spring wheat and spring barley are given. E.D.K.

N81-12479*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
AS-BUILT DESIGN SPECIFICATION FOR PROPORTION ESTIMATE SOFTWARE SUBSYSTEM
S. OBrien, Principal Investigator Jul. 1980 81 p ERTS
(Contract NAS9-15800)
(E81-10002; NASA-CR-163560; LEMSCO-15353; JSC-16807) Avail: NTIS HC A05/MF A01 CSCL 05B

The Proportion Estimate Processor evaluates four estimation techniques in order to get an improved estimate of the proportion of a scene that is planted in a selected crop. The four techniques to be evaluated were provided by the techniques development section and are: (1) random sampling; (2) proportional allocation, relative count estimate; (3) proportional allocation, Bayesian estimate; and (4) sequential Bayesian allocation. The user is given two options for computation of the estimated mean square error. These are referred to as the cluster calculation option and the segment calculation option. The software for the Proportion Estimate Processor is operational on the IBM 3031 computer.
E.D.K.

N81-12480*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
HOUSTON AREA MULTICROP INSPECTION TRIPS
E. W. Dunham, Principal Investigator Jul. 1980 49 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10003; NASA-CR-163557; FC-LO-00437; LEMSCO-14584; JSC-16351) Avail: NTIS HC A03/MF A01 CSCL 02C

The phenology of crops such as corn, cotton, soybeans, sorghum, sunflowers, and rice and their observed signatures on LANDSAT imagery was studied. This was accomplished by photographing the various crops in segments 275 and 276 located in Wharton County, Texas and comparing those photographs with LANDSAT imagery of the same dates. These comparisons gave insight as to why a particular crop growth stage appeared as a definite signature on LANDSAT and how the percentage of ground cover of various crops affected the signatures on LANDSAT imagery. Numerous crop growth stages could not be directly compared due to cloud cover during several LANDSAT overpasses. E.D.K.

N81-12481*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM Quarterly Report, 1 Apr. - 30 Jun. 1980
R. P. Mroczynski, Principal Investigator and D. Freeman 18 Jul. 1980 20 p ERTS
(Contract NAS9-15325)
(E81-10004; NASA-CR-163553; LARS-CR-071880) Avail: NTIS HC A02/MF A01 CSCL 02F

Remote sensing technology providing St. Regis with an independent operational system and having LANDSAT data as a significant and viable contributor was documented and transferred. Primary emphasis was placed on documenting developmental LARSYS (LARSYSDV) software modules. Timelines and a short description of the software documentation process is given. E.D.K.

N81-12482*# Freiburg Univ. (West Germany). Geographisches Institut.
IMAGE PROCESSING OF HCMM-SATELLITE THERMAL IMAGES FOR SUPERPOSITION WITH OTHER SATELLITE IMAGERY AND TOPOGRAPHIC AND THEMATIC MAPS
H. Gossmann and P. Haberaecker, Principal Investigators (DFVLR, Oberpfaffenhofen, West Germany) Ispra, Italy Joint Research Centre of the European Communities Jan. 1980 42 p refs Sponsored by NASA and Deutsche Forschungsgemeinschaft Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; nondomestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E81-10005; NASA-CR-163545) Avail: NTIS HC A03/MF A01 CSCL 05B

The southwestern part of Central Europe between Basal and Frankfurt was used in a study to determine the accuracy with which a regionally bounded HCMM scene could be rectified with respect to a preassigned coordinate system. The scale to which excerpts from HCMM data can be sensibly enlarged and the question of how large natural structures must be in order to be identified in a satellite thermal image with the given resolution were also examined. Relief and forest and population distribution maps and a land use map derived from LANDSAT data were digitalized and adapted to a common reference system and then combined in a single multichannel data system. The control points for geometrical rectification were determined using the coordinates of the reference system. The multichannel scene was evaluated in several different manners such as the correlation of surface temperature and relief, surface temperature and land use, or surface temperature and built up areas. A.R.H.

N81-12483*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PROPORTION ESTIMATION USING PRIOR CLUSTER PURITIES

G. R. Terrell, Principal Investigator Jul. 1980 17 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10006; NASA-CR-160776; SR-LO-00465; LEMSCO-15163; JSC-16754) Avail: NTIS HC A02/MF A01 CSCL 05B

The prior distribution of CLASSY component purities is studied, and this information incorporated into maximum likelihood crop proportion estimators. The method is tested on Transition Year spring small grain segments. Author

N81-12484*# State Univ. Coll. of New York at Oneonta.

EVALUATION OF THREE TECHNIQUES FOR CLASSIFYING URBAN LAND COVER PATTERNS USING LANDSAT MSS DATA

Paul R. Baumann, Principal Investigator Bay St. Louis, Miss. NASA. Earth Resources Lab. Jan. 1979 41 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10007; NASA-CR-163511; Rept-178) Avail: NTIS HC A03/MF A01 CSCL 08B

Three computer quantitative techniques for determining urban land cover patterns are evaluated. The techniques examined deal with the selection of training samples by an automated process, the overlaying of two scenes from different seasons of the year, and the use of individual pixels as training points. Evaluation is based on the number and type of land cover classes generated and the marks obtained from an accuracy test. New Orleans, Louisiana and its environs form the study area. Author

N81-12485*# Tennessee Valley Authority, Chattanooga. Div. of Environmental Planning.

TROPHIC CLASSIFICATION OF TENNESSEE VALLEY AREA RESERVOIRS DERIVED FROM LANDSAT MULTISPECTRAL SCANNER DATA

Dennis L. Meinert, Donald L. Malone, Alan W. Voss, Principal Investigators, and Frank L. Scarpace (Wisconsin Univ. - Madison) [1980] 73 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10008; NASA-CR-163528) Avail: NTIS HC A04/MF A01 CSCL 08H

LANDSAT MSS data from four different dates were extracted from computer tapes using a semiautomated digital data handling and analysis system. Reservoirs were extracted from the surrounding land matrix by using a Band 7 density level slice of 3; and descriptive statistics to include mean, variance, and ratio between bands for each of the four bands were calculated. Significant correlations (> 0.80) were identified between the MSS statistics and many trophic indicators from ground truth water quality data collected at 35 reservoirs in the greater Tennessee Valley region. Regression models were developed which gave significant estimates of each reservoir's trophic state as defined by its trophic state index and explained in all four LANDSAT frames at least 85 percent of the variability in the data. To illustrate the spatial variations within reservoirs as well as the relative variations between reservoirs, a table look up elliptical classification was used in conjunction with each reservoir's trophic state index to classify each reservoir on a pixel by pixel basis and produce color coded thematic representations. A.R.H.

N81-12486*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.

SHORELINE AS A CONTROLLING FACTOR IN COMMERCIAL SHRIMP PRODUCTION

Kenneth H. Faller, Principal Investigator Dec. 1978 46 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E81-10009; NASA-TM-82186) Avail: NTIS HC A03/MF A01 CSCL 08A

An ecological model was developed that relates marsh detritus export and shrimp production, based on the hypothesis that the shoreline is a controlling factor in the production of shrimp through regulation of detritus export from the marsh. LANDSAT data were used to develop measurements of shoreline length and area of marsh having more than 5.0 km shoreline/sq km for the coast of Louisiana, demonstrating the capability of remote sensing to provide important geographic information. These factors were combined with published tidal ranges and salinities to develop a mathematical model that predicted shrimp production for nine geographic units of the Louisiana coast, as indicated by the long term average commercial shrimp yield. The mathematical model relating these parameters and the shrimp production is consistent with an energy flow model describing the interaction of detritus producing marshlands with shrimp nursery grounds and inshore shrimping areas. The analysis supports the basic hypothesis and further raises the possibility of applications to coastal zone management requirements. Author

N81-12487*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EARTH OBSERVATIONS DIVISION VERSION OF THE LABORATORY FOR APPLICATIONS OF REMOTE SENSING SYSTEM (EOD-LARSYS) USER GUIDE FOR THE IBM 370/148. VOLUME 2: USER REFERENCE MANUAL

P. J. Aucoin, J. Stewart, and M. F. McKay, Principal Investigators Jun. 1980 404 p refs ERTS
(Contract NAS9-15800)
(E81-10010; NASA-CR-163562; LEMSCO-12564-Vol-2-Rev-A; JSC-13821-Vol-2-Rev-A) Avail: NTIS HC A18/MF A01 CSCL 05B

This document presents instructions for analysts who use the EOD-LARSYS as programmed on the Purdue University IBM 370/148 (recently replaced by the IBM 3031) computer. It presents sample applications, control cards, and error messages for all processors in the system and gives detailed descriptions of the mathematical procedures and information needed to execute the system and obtain the desired output. EOD-LARSYS is the JSC version of an integrated batch system for analysis of multispectral scanner imagery data. The data included is designed for use with the as built documentation (volume 3) and the program listings (volume 4). The system is operational from remote terminals at Johnson Space Center under the virtual machine/conversational monitor system environment. Author

N81-12488*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div.

AS-BUILT DESIGN SPECIFICATION FOR P1A SOFTWARE SYSTEM MODIFIED DISPLAY SUBSYSTEM

C. L Horton and A. S. Story, Principal Investigators Jun. 1980 352 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10011; NASA-CR-163561; LEMSCO-15151; JSC-16750) Avail: NTIS HC A16/MF A01 CSCL 05B

This document contains the design of the proportional estimate processor which was written to satisfy the software requirement of Part A of the P1A experiment. The purposes of the project are: (1) to select the dots to be labelled; (2) to create tables of green numbers and brightness values for all selected dots per acquisition; (3) to create scatter plots of green numbers vs brightness for each acquisition for all selected dots. If labels have been provided then scatter plots of only categories of interest

can be optionally produced; and (4) to produce trajectory plots of green number vs brightness at differing acquisition times for each dot. These plots need to be in the same order as the list of selected dots. When labels are provided only plots of dots of categories of interest are to be produced. Author

N81-12489*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

CROP CALENDARS FOR THE US, USSR, AND CANADA IN SUPPORT OF THE EARLY WARNING PROJECT

T. Hodges, M. L. Sestak, and M. H. Trenchard, Principal Investigators Jul. 1980 35 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10012; NASA-CR-163555; SR-LO-00450; LEMSCO-14673; JSC-16359) Avail: NTIS HC A03/MF A01 CSCL 02C

New crop calendars are produced for U.S. regions where several years of periodic growth stage observations are available on a CRD basis. Preexisting crop calendars from the LACIE are also collected as are U.S. crop calendars currently being created for the Foreign Commodities Production Forecast project. For the U.S.S.R. and Canada, no new crop calendars are created because no new data are available. Instead, LACIE crop calendars are compared against simulated normal daily temperatures and against the Robertson wheat and Williams barley phenology models run on the simulated normal temperatures. Severe inconsistencies are noted and discussed. For the U.S.S.R., spring and fall planting dates can probably be estimated accurately from satellite or meteorological data. For the starter model problem, the Feyerherm spring wheat model is recommended for spring planted small grains, and the results of an analysis are presented. For fall planted small grains, use of normal planting dates supplemented by spectral observation of an early stage is recommended. The importance of nonmeteorological factors as they pertain to meteorological factors in determining fall planting is discussed. Crop calendar data available at the Johnson Space Center for the U.S., U.S.S.R., Canada, and other countries are inventoried. Author

N81-12490*# Oregon State Univ., Corvallis. Environmental Remote Sensing Applications Lab.

EIGHTH YEAR PROJECTS AND ACTIVITIES OF THE ENVIRONMENTAL REMOTE SENSING APPLICATIONS LABORATORY (ERSAL) Annual Progress Report, 1 Apr. 1979 - 31 Mar. 1980

Anthony J. Lewis, Dennis L. Isaacson, and Barry J. Schrumpf, Principal Investigators 31 Mar. 1980 93 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 Original contains color illustrations ERTS

(Grant NGL-38-002-053)

(E81-10013; NASA-CR-163533) Avail: NTIS HC A05/MF A01 CSCL 05A

Projects completed for the NASA Office of University Affairs include the application of remote sensing data in support of rehabilitation of wild fire damaged areas and the use of LANDSAT 3 return beam vidicon in forestry mapping applications. Continuing projects for that office include monitoring western Oregon timber clearcut; detecting and monitoring wheat disease; land use monitoring for tax assessment in Umatilla, Lake, and Morrow Counties; and the use of Oregon Air National Guard thermal infrared scanning data. Projects funded through other agencies include the remote sensing inventory of elk in the Blue Mountains; the estimation of burned agricultural acreage in the Willamette Valley; a resource inventory of Deschutes County; and hosting a LANDSAT digital workshop. A.R.H.

N81-12491*# Oregon State Univ., Corvallis.

THE APPLICATION OF REMOTELY SENSED DATA IN SUPPORT OF EMERGENCY REHABILITATION OF WILD-FIRE-DAMAGE AREAS

Dennis L. Isaacson, H. Gregory Smith, and Cassandra J. Alexander, Principal Investigators 9 May 1980 44 p refs Original contains color illustrations ERTS

(Grant NGL-38-002-053)

(E81-10014; NASA-CR-163534; ERSAL-80-1) Avail: NTIS HC A03/MF A01 CSCL 05B

The depth, texture, and water holding capacity of the soil before the fire in the Bridge Creek area of Deschutes National Forest (1979) were determined from available aerial photography and LANDSAT MSS digital data. Three days after the fire was out, complete coverage of the burned area was acquired on 35 mm color infrared film from a near vertical or low oblique perspective. These photographs were used in assessing the condition of vegetation, and in predicting the likelihood of survival. Negatives from vertical natural photography obtained during the same flight were used to produce 3R prints from which large scale mosaics of the entire burned area were obtained. LANDSAT MSS data obtained on the day the fire was under control were used to evaluate vegetative vigor (by calculating a band 7/band 5 ratio value for each spectral class) and to determine the boundary between altered and unaltered land. A.R.H.

N81-12492*# Vermont Univ., Burlington. School of Natural Resources.

REMOTE SENSING PROGRAM ACTIVITY REPORT Progress Report, 1 Jun. 1978 - 31 May 1980

Roy A. Whitmore, Jr., Principal Investigator, Hugo H. John, and Gary S. Smith 31 May 1980 11 p ERTS

(Grant NsG-7453)

(E81-10015; NASA-CR-163532) Avail: NTIS HC A02/MF A01 CSCL 05A

Major accomplishments in an effort to encourage investigation and technology transfer for practical applications of remote sensing to solve Earth resources problems in Vermont include: (1) acquisition, installation, and operation of the ORSER digital processing system on the University's IBM 3031 computer; (2) acquisition and operation of printing and CRT computer terminals for remote access to computer facilities for analysis of remotely sensed digital tape; (3) acquisition and operation of optical interpretation and image transfer devices for use with all types of aerial photography; (4) development of audio visual and other training materials for use in presentations, workshops, and short courses to enhance technology transfer; and (5) cooperation government agencies in demonstration projects to show the feasibility of using remote sensing technology. A.R.H.

N81-12493*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STUDIES RELATED TO MAGSAT Progress Report, period ending Sep. 1980

David P. Stern, Principal Investigator Sep. 1980 3 p refs ERTS

(E81-10016; NASA-TM-82225) Avail: NTIS HC A02/MF A01 CSCL 08G

Two models of the geomagnetic field, derived from Magsat data were compared. One model came from a data set including both the magnitude and the direction of the field. The other resembles earlier POGO models by using only the field magnitude observed from space. The comparison confirmed predictions that such models contain large spurious components of a harmonic nature structure. After the spurious terms in the second model were estimated, they were subtracted. It was noticed that other spurious effects, of smaller amplitude, still existed. While the primary Backus effect tends to introduce significant errors in low-order harmonic terms, these secondary effects are mainly significant in the higher harmonics, since they decay rather slowly with increasing harmonic order, and may, therefore, mask the natural decrease of such terms. FORTRAN programs were developed for the IBM 1800 in order to transform the given magnetic field models into dipole coordinates, and to compare the coefficients of the expansions. A program was also coded in BASIC (for an HP 9830) deriving the d sequences of higher order spurious terms. A.R.H.

N81-12494*# Wisconsin Univ., Madison. Inst. for Environmental Studies.

FOR MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, Aug. 1978 - Jul. 1979

Ralph W. Kiefer, Principal Investigator Jul. 1979 50 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198

ERTS
(Grant NGL-50-002-127)
(E81-10017; NASA-CR-163527) Avail: NTIS HC A03/MF A01 CSCL 08H

Research on the application of remote sensing to problems of water resources was concentrated on sediments and associated nonpoint source pollutants in lakes. Further transfer of the technology of remote sensing and the refinement of equipment and programs for thermal scanning and the digital analysis of images were also addressed. J.M.S.

N81-12495*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.

GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A (HEAT CAPACITY MAPPING MISSION) Quarterly Report, 1 Apr. - 30 Jun. 1980

Ronald J. P. Lyon and A. E. Prelat, Principal Investigators 30 Jun. 1980 1 p HCMM
(Contract NAS5-24232)
(E81-10018; NASA-CR-163510) Avail: NTIS HC A02/MF A01 CSCL 08B

Further digital processing of HCMM digital data was performed to extract the temperature from the day/night passes to calculate the apparent delta T in the Yerington, Nevada mine area. Further processing is needed to observe the atmospheric effect. Author

N81-12496*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

EFFECTS OF MANAGEMENT PRACTICES ON REFLECTANCE OF SPRING WHEAT CANOPIES

C. S. T. Daughtry, M. E. Bauer, D. W. Crecelius, and M. M. Hixson, Principal Investigators May 1980 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15466; NAS9-14970; Proj. AgRISTARS)
(E81-10019; NASA-CR-163507; SR-PO-00458; LARS-TR-051580) Avail: NTIS HC A02/MF A01 CSCL 02C

The effects of available soil moisture, planting date, nitrogen fertilization, and cultivar on reflectance of spring wheat (Triticum aestivum L.) canopies were investigated. Spectral measurements were acquired on eight dates throughout the growing season, along with measurements of crop maturity stage, leaf area index, biomass, plant height, percent soil cover, and soil moisture. Planting date and available soil moisture were the primary agronomic factors which affected reflectance of spring wheat canopies from tillering to maturity. Comparisons of treatments indicated that during the seedling and tillering stages planting date was associated with 36 percent and 85 percent of variation in red and near infrared reflectances, respectively. As the wheat headed and matured, less of the variation in reflectance was associated with planting date and more with available soil moisture. By mid July, soil moisture accounted for 73 percent and 69 percent of the variation in reflectance in red and near infrared bands, respectively. Differences in spectral reflectance among treatments were attributed to changes in leaf area index, biomass, and percent soil cover. Cultivar and N fertilization rate were associated with very little of the variation in the reflectance of these canopies. A.R.H.

N81-12497*# Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Feb. - 30 Apr. 1980

Ray D. Jackson, Principal Investigator 30 Apr. 1980 1 p HCMM
(NASA Order S-40255-B)
(E81-10020; NASA-CR-163506) Avail: NTIS HC A02/MF A01 CSCL 08H

Tapes for day and night passes on May 16 and May 20, 1978 and a day pass on May 3, 1980 were processed. Results indicate that it is extremely difficult to locate a field of 9 pixel size and temperature data from the HCMM are consistently lower than temperatures measured with a scanner flown at low altitudes. The temperature differences between the satellite and aircraft data appear to be temperature dependent, being smaller at lower temperatures. Three data points are [in the format (airc, HCMM)] (12,9), (30,23), and (39,30). The linear equation for these three points is T sub HCMM = 0.778 T sub airc -0.33. J.M.S.

N81-12498*# Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.

HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980

Ray D. Jackson, Principal Investigator 31 Jan. 1980 1 p HCMM
(NASA Order S-40255-B)
(E81-10021; NASA-CR-163505) Avail: NTIS HC A02/MF A01 CSCL 08H

Progress in the processing of CCT's for both day and night passes for May 16 and 20, 1978 and a day pass on May 3, 1980 is reported. J.M.S.

N81-12499*# Canada Centre for Remote Sensing, Ottawa (Ontario).

HCMM/SOIL MOISTURE EXPERIMENT Progress Report

Josef Cihlar, Principal Investigator 31 Aug. 1980 7 p refs Sponsored by NASA HCMM
(E81-10022; NASA-CR-163504) Avail: NTIS HC A02/MF A01 CSCL 08M

Progress in the compilation and analysis of airborne and ground data to determine the relationship between the maximum surface minus maximum air temperature differential (delta Tsa) and available water (PAW) is reported. Also, results of an analysis of HCMM images to determine the effect of cloud cover on the availability of HCMM-type data are presented. An inverse relationship between delta Tsa and PAW is indicated along with stable delta Tsa vs. PAW distributions for fully developed canopies. Large variations, both geographical and diurnal, in the cloud cover images are reported. The average monthly daytime cloud cover fluctuated between 40 and 60 percent. J.M.S.

N81-12500*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

STRUCTURAL MAPPING FROM MSS-LANDSAT IMAGERY: A PROPOSED METHODOLOGY FOR INTERNATIONAL GEOLOGICAL CORRELATION STUDIES

Nelson deJesusParada, Principal Investigator, Edison Crepani, and Paulo Roberto Martini Jun. 1980 10 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA ERTS
(E81-10023; NASA-CR-163574; INPE-1787-RPE/159) Avail: NTIS HC A02/MF A01 CSCL 08B

A methodology is proposed for international geological correlation studies based on LANDSAT-MSS imagery. Bullard's model of continental fit and compatible structural trends between Northeast Brazil and the West African counterpart. Six extensive lineaments in the Brazilian study area are mapped and discussed according to their regional behavior and in relation to the adjacent continental margin. Among the first conclusions, correlations were found between the Sobral Pedro II Lineament and the megafaults that surround the West African craton; and the Pernambuco Lineament with the Ngaurandere Linemanet in Cameroon. Ongoing research to complete the methodological stages includes the mapping of the West African structural framework, reconstruction of the pre-drift puzzle, and an analysis of the counterpart correlations. Author

N81-12501*# Lille Univ. (France). Lab. d'Optique Atmospherique.

SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE

P. Y. Deschamps, M. Crepon (Museum d'Histoire Naturelle, Paris), J. M. Monget (Ecole des Mines, Valbonne, France), F. Verger, Principal Investigators (Ecole Normale Superieure, Montrouge, France), R. Frouin, J. Cassanet (Ecole Normale Superieure, Montrouge, France), and L. Wald (Ecole des Mines, Valbonne, France) Apr. 1980 48 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E81-10024; NASA-CR-163441; PR-3) Avail: NTIS

HC A03/MF A01 CSCL 08C

The various thermal gradients in the coastal zones of France were mapped with regard to natural phenomena and man made thermal effluents. The mesoscale thermal features of the English Channel, the Bay of Biscay, and the northwestern Mediterranean Sea were also studied. The evolution of the thermal gradients generated by the main estuaries of the French coastal zones was investigated along with the modeling of diurnal heating of the sea surface and its influence on the oceanic surface layers. J.M.S.

N81-12502*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report

Toby N. Carlson, Principal Investigator 1 Sep. 1980 5 p HCMM

(Contract NAS5-24264)

(E81-10025; NASA-CR-163503; QR-11) Avail: NTIS HC A02/MF A01 CSCL 13B

The first analyses of the Washington, D.C. area was completed in which a method was employed to determine the surface energy balance, moisture availability, and thermal inertia. Further analyses of the Clarksville, Tennessee area during project STATE were completed. To test a newly operational interactive system, a temperature study of the Central Pennsylvania Barrens was performed. J.M.S.

N81-12503*# Business and Technological Systems, Inc., Seabrook, Md.

EQUIVALENT SOURCE MODELING OF THE MAIN FIELD USING MAGSAT DATA Quarterly Report, 1 Apr. - 30 Jun. 1980

30 Jun. 1980 4 p ERTS

(Contract NAS5-26047)

(E81-10026; NASA-CR-163502; QR-2) Avail: NTIS HC A02/MF A01 CSCL 08F

Progress is reported on software development for equivalent dipole source modeling of the main magnetic field. This includes a spatial statistical output capability, a subroutine to compute the equivalent spherical harmonic representation from the dipole distribution, and capability to plot the global locations of the dipoles and the values of the source magnetization. J.M.S.

N81-12504*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

AN ASSESSMENT OF LANDSAT DATA ACQUISITION HISTORY ON IDENTIFICATION AND AREA ESTIMATION OF CORN AND SOYBEANS

Marilyn M. Hixson, Marvin E. Bauer, and Donna K. Scholz, Principal Investigators (EROS Data Center) 1980 6 p refs Repr. from Machine Process. of Remotely Sensed Data, Jun. 1980 p 72-77 Presented at the Machine Process. of Remotely Sensed Data Symp., 1980 ERTS

(Contract NAS9-15466)

(E81-10027; NASA-CR-163445) Avail: NTIS HC A02/MF A01 CSCL 02C

Multitemporally registered LANDSAT MSS data from four acquisitions during the 1978 growing season were used in classification of eight sample segments in Iowa and Indiana. The results illustrate that use of LANDSAT acquisition when corn has tasseled is critical, as this is the optimum time for separation of corn and soybeans. An early season acquisition when the summer crops appear as bare soil can be beneficial in reducing the confusion between these two crops and other cover types. A subset of one visible and one infrared band from each date was found to produce results not significantly different from the use of all bands. Selection of a subset of these bands may also be feasible for multitemporal analysis. A.R.H.

N81-12505*# Minnesota Univ., Minneapolis. Space Science Center.

A STUDY OF MINNESOTA LAND AND WATER RESOURCES USING REMOTE SENSING, VOLUME 13 Progress Report, 1 Jan. - 31 Dec. 1979

1 Jan. 1980 140 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGL-24-005-263)

(E81-10028; NASA-CR-163530) Avail: NTIS HC A07/MF A01 CSCL 08B

Progress in the use of LANDSAT data to classify wetlands in the Upper Mississippi River Valley and efforts to evaluate stress in corn and soybean crops are described. Satellite remote sensing data was used to measure particle concentrations in Lake Superior and several different kinds of remote sensing data were synergistically combined in order to identify near surface bedrock in Minnesota. Data analysis techniques which separate those activities requiring extensive computing form those involving a great deal of user interaction were developed to allow the latter to be done in the user's office or in the field. For individual titles, see N81-12506 through N81-12510.

N81-12506*# Minnesota Univ., St. Paul. Remote Sensing Lab.

LANDSAT APPLICATIONS TO WETLANDS CLASSIFICATION IN THE UPPER MISSISSIPPI RIVER VALLEY Ph.D. Thesis. Final Report

Thomas M. Lillesand and Lee F. Werth, Principal Investigators *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 5-29 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N81-12505 03-43)

Avail: NTIS HC A07/MF A01 CSCL 08B

A 25% improvement in average classification accuracy was realized by processing double-date vs. single-date data. Under the spectrally and spatially complex site conditions characterizing the geographical area used, further improvement in wetland classification accuracy is apparently precluded by the spectral and spatial resolution restrictions of the LANDSAT MSS. Full scene analysis of scanning densitometer data extracted from scale infrared photography failed to permit discrimination of many wetland and nonwetland cover types. When classification of photographic data was limited to wetland areas only, much more detailed and accurate classification could be made. The integration of conventional image interpretation (to simply delineate wetland boundaries) and machine assisted classification (to discriminate among cover types present within the wetland areas) appears to warrant further research to study the feasibility and cost of extending this methodology over a large area using LANDSAT and/or small scale photography. E.D.K.

N81-12507*# Minnesota Univ., St. Paul. Remote Sensing Lab.

DEVELOPMENT OF ALTERNATIVE DATA ANALYSIS TECHNIQUES FOR IMPROVING THE ACCURACY AND SPECIFICITY OF NATURAL RESOURCE INVENTORIES MADE WITH DIGITAL REMOTE SENSING DATA Progress Report, 1 Jul. - 31 Dec. 1979

Thomas M. Lillesand and Douglas E. Meisner, Principal Investigators *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 30-43 ERTS (For primary document see N81-12505 03-43)

Avail: NTIS HC A07/MF A01 CSCL 05B

An investigation was conducted into ways to improve the involvement of state and local user personnel in the digital image analysis process by isolating those elements of the analysis process which require extensive involvement by field personnel and providing means for performing those activities apart from a computer facility. In this way, the analysis procedure can be converted from a centralized activity focused on a computer facility to a distributed activity in which users can interact with the data at the field office level or in the field itself. A general image processing software was developed on the University of Minnesota computer system (Control Data Cyber models 172 and 74). The use of color hardcopy image data as a primary medium in supervised training procedures was investigated and digital display equipment and a coordinate digitizer were procured. E.D.K.

N81-12508*# Geological Survey, Minneapolis, Minn.

SYNERGISTIC RELATIONSHIPS AMONG REMOTE-SENSING AND GEOPHYSICAL MEDIA: GEOLOGICAL AND HYDROLOGICAL APPLICATIONS

Joseph E. Goebel, Matt Walton, and Lawrence G. Batten, Principal Investigators *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 44-87 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N81-12505 03-43)
Avail: NTIS HC A07/MF A01 CSCL 08G

The synergistic relationships among LANDSAT imagery, Skylab photographs, and aerial photographs were useful for establishing areas of near surface bedrock. Lineaments were located on LANDSAT imagery and aerial photographs during 1978 and near surface water tables were to be located during 1980. Both of these subjects can be identified by remote sensing methods more reliably than individual outcrops, which are small and occur in a wide variety of environments with a wide range of responses. Bedrock outcrops themselves could not be resolved by any of the data sources used, nor did any combination of data sources specifically identify rock at the ground surface. The data sources could not simply be combined mathematically to produce a visual image of probable areas of near surface bedrock. Outcrops and near surface bedrock had to be verified visually at the site. Despite these drawbacks, a procedure for locating areas of near surface bedrock within which actual surface outcrops may occur was developed. E.D.K.

N81-12509*# Minnesota Univ., St. Paul. Dept. of Soil Science.
A PROJECT TO EVALUATE MOISTURE STRESS IN CORN AND SOYBEAN AREAS OF WESTERN AND SOUTHWESTERN MINNESOTA
R. H. Rust and Pierre Robert, Principal Investigators *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 88-106 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N81-12505 03-43)
Avail: NTIS HC A07/MF A01 CSCL 02C

Remote sensing techniques, particularly LANDSAT data, were used to assess soil moisture stress through crop signature in southwestern Minnesota. Related objectives were: localization of droughty, well drained, and poorly drained soils; detection of stress from hail, wind, and disease damage; and the use of remote sensing data for agricultural management. Since the amount and distribution of precipitation were adequate during the 1977 and 1978 growing seasons, no significant stress occurred. Crop conditions were very favorable. As a result, crop signatures were too uniform to reflect soilscape variations and crop condition changes. In 1979 precipitation was again adequate to excess, particularly in June and August. In some cases, poorly drained sites especially, stress conditions developed as a result of excess of water and could be identified on color infrared photographs. E.D.K.

N81-12510*# Minnesota Univ., Duluth. Dept. of Physics.
MEASUREMENT OF SUSPENDED SOLIDS IN LAKES AND OCEANS USING SATELLITE REMOTE SENSING DATA
Michael Sydor, Principal Investigator *In* Minnesota Univ. A Study of Minn. Land and Water Resources Using Remote Sensing, Vol. 13 1 Jan. 1980 p 107-137 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (For primary document see N81-12505 03-43)
Avail: NTIS HC A07/MF A01 CSCL 13B

Using satellite remote sensing data to measure low concentrations of suspended solids in lakes and oceans requires careful evaluation of background signals from the atmosphere and the water surface. Typical background corrections for Lake Superior are presented and the spectral distribution of the residual radiance from three major categories of turbidity in the lake are determined. The results indicate that for large bodies of water, some general information on atmospheric scattering, water clarity, and the optical properties of suspended solids allows estimates of concentrations of suspended solids to within + or - 0.5 mg/L without using real time ground truth data. Under calibrated conditions the threshold detection level is 0.3 mg/L for the fine particulates dispersed throughout the lake and 1 mg/L for the highly light absorbing effluent from rivers. Comparisons of the minimum reflectance over the open lake areas with reflection from the highly absorbing tannin water from rivers provides a check on the clarity of the atmosphere and the excessive background scatter from the water surface. E.D.K.

N81-12511*# South Dakota State Univ., Brookings. Remote Sensing Inst.
REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Annual Progress Report, 1 Jul. 1979 - 30 Jun. 1980
Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, M. E. DeVries, J. C. Eidenshink, R. Fowler, J. L. Heilman, and F. A. Schmer 30 Jun. 1980 165 p refs Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Grant NGL-42-003-007)
(E81-10029; NASA-CR-163529; SDSU-RSI-80-06) Avail: NTIS HC A08/MF A01 CSCL 08B

Cooperative projects between RSI and numerous South Dakota agencies have provided a means of incorporating remote sensing techniques into operational programs. Eight projects discussed in detail are: (1) detection of high moisture zones near interstate 90; (2) thermal infrared census of Canada geese in South Dakota; (3) dutch elm disease detection in urban environment; (4) a feasibility study for monitoring effective precipitation in South Dakota using TIROS-N; (5) open and abandoned dump sites in Spink county; (6) the influence of soil reflectance on LANDSAT signatures of crops; (7) A model implementation program for Lake Herman watershed; and (8) the Six-Mile Creek investigation follow-on. E.D.K.

N81-12512*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
A METHOD FOR THE PROCESSING AND ANALYSIS OF DIGITAL TERRAIN ELEVATION DATA
Bobby G. Junkin, Principal Investigator Jan. 1979 85 p refs Original contains color illustrations ERTS
(E81-10030; NASA-TM-82187; ERL-177) Avail: NTIS HC A05/MF A01 CSCL 05B

A method is presented for the processing and analysis of digital topography data that can subsequently be entered in an interactive data base in the form of slope, slope length, elevation, and aspect angle. A discussion of the data source and specific descriptions of the data processing software programs are included. In addition, the mathematical considerations involved in the registration of raw digitized coordinate points to the UTM coordinate system are presented. Scale factor considerations are also included. Results of the processing and analysis are illustrated using the Shiprock and Gallup Quadrangle test data. E.D.K.

N81-12513*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
SUPPLEMENTAL US/CANADA WHEAT AND BARLEY EXPLORATORY EXPERIMENT IMPLEMENTATION PLAN: EVALUATION OF A PROCEDURE 1A TECHNOLOGY Interim Report
Jun. 1980 44 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10031; NASA-CR-160777; FC-LO-00609; LEMSCO-15042; JSC-16364) Avail: NTIS HC A03/MF A01 CSCL 02C

A plan is presented for a supplemental experiment to evaluate a sample allocation technique for selecting picture elements from remotely sensed multispectral imagery for labeling in connection with a new crop proportion estimation technique. The method of evaluating an improved allocation and proportion estimation technique is also provided. A.R.H.

N81-12514*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ILLUSTRATION OF YEAR-TO-YEAR VARIATION IN WHEAT SPECTRAL PROFILE CROP GROWTH CURVES

Pete Gonzalez and Clay Jones, Principal Investigators Aug. 1980 37 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Proj. AgRISTARS)
(E81-10032; NASA-TM-82199; SR-JO-00489; JSC-16817) Avail: NTIS HC A03/MF A01 CSCL 02C

Data previously compiled on the year to year variability of spectral profile crop growth parameters for spring and winter wheat in Kansas, Oklahoma, and the Dakotas were used with a profile model to develop graphs illustrating spectral profile crop growth curves for a number of years and a number of spring and winter wheat segments. These curves show the apparent variability in spectral profiles for wheat from one year to another within the same segment and from one segment to another within the same year. A.R.H.

N81-12515*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
MINIMUM VARIANCE GEOGRAPHIC SAMPLING
G. R. Terrell, Principal Investigator Jul. 1980 12 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10033; NASA-CR-163556; SR-LO-00467; LEMSCO-15179; JSC-16370) Avail: NTIS HC A02/MF A01 CSCL 08F

Resource inventories require samples with geographical scatter, sometimes not as widely spaced as would be hoped. A simple model of correlation over distances is used to create a minimum variance unbiased estimate population means. The fitting procedure is illustrated from data used to estimate Missouri corn acreage. A.R.H.

N81-12516*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
ESTIMATION OF WITHIN-STRATUM VARIANCE FOR SAMPLE ALLOCATION: FOREIGN COMMODITY PRODUCTION FORECASTING
R. S. Chhikara and Charles R. Perry, Jr., Principal Investigators (NASA. Johnson Space Center) Jul. 1980 49 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10034; NASA-CR-163554; FC-LO-00428; LEMSCO-14067; JSC-16343) Avail: NTIS HC A03/MF A01 CSCL 02C

The problem of determining the stratum variances required for an optimum sample allocation for remotely sensed crop surveys is investigated with emphasis on an approach based on the concept of stratum variance as a function of thesampling unit size. A methodology using the existing and easily available information of historical statistics is developed for obtaining initial estimates of stratum variances. The procedure is applied to variance for wheat in the U.S. Great Plains and is evaluated based on the numerical results obtained. It is shown that the proposed technique is viable and performs satisfactorily with the use of a conservative value (smaller than the expected value) for the field size and with the use of crop statistics from the small political division level. Author

N81-12517*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
STRATUM VARIANCE ESTIMATION FOR SAMPLE ALLOCATION IN CROP SURVEYS
Charles R. Perry, Jr. (NASA. Johnson Space Center) and Raj S. Chhikara, Principal Investigators Jul. 1980 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency of the Am. Statist. Assoc., Surv. Res. Methods Sect., Houston, Tex., 11-14 Aug. 1980 ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10035; NASA-CR-163552; FC-JO-00468; JSC-16371) Avail: NTIS HC A02/MF A01 CSCL 02C

The problem of determining stratum variances needed in achieving an optimum sample allocation for crop surveys by remote sensing is investigated by considering an approach based on the concept of stratum variance as a function of the sampling unit size. A methodology using the existing and easily available information of historical crop statistics is developed for obtaining initial estimates of tratum variances. The procedure is applied to estimate stratum variances for wheat in the U.S. Great Plains and is evaluated based on the numerical results thus obtained. It is shown that the proposed technique is viable and performs satisfactorily, with the use of a conservative value for the field size and the crop statistics from the small political subdivision level, when the estimated stratum variances were compared to those obtained using the LANDSAT data. Author

N81-12518*# Minnesota Univ., Minneapolis.
REMOTE SENSING AND IMAGE INTERPRETATION
Thomas M. Lillesand and Ralph W. Kiefer, Principal Investigators (Wisconsin Univ. - Madison) New York John Wiley and Sons 1979 658 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10036; NASA-CR-163531; LC-78-27846; ISBN-0-471-02609-3) Avail: NTIS HC A99/MF A01 CSCL 14E

A textbook prepared primarily for use in introductory courses in remote sensing is presented. Topics covered include concepts and foundations of remote sensing; elements of photographic systems; introduction to airphoto interpretation; airphoto interpretation for terrain evaluation; photogrammetry; radiometric characteristics of aerial photographs; aerial thermography; multispectral scanning and spectral pattern recognition; microwave sensing; and remote sensing from space. A.R.H.

N81-12519*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
MULTISTAGE VARIABLE PROBABILITY FOREST VOLUME INVENTORY
James E. Anderson, Principal Investigator Mar. 1979 31 p refs ERTS
(E81-10037; NASA-TM-82198; ERL-179) Avail: NTIS HC A03/MF A01 CSCL 02F

The net board foot volume (Scribner log rule) of the standing Ponderosa pine timber on the Defiance Unit of the Navajo Nation's forested land was estimated using a multistage forest volume inventory scheme with variable sample selection probabilities. The inventory designed to accomplish this task required that both LANDSAT MSS digital data and aircraft acquired data be used to locate one acre ground plits, which were subsequently visited by ground teams conducting detailed tree measurements using an optical dendrometer. The dendrometer measurements were then punched on computer input cards and were entered in a computer program developed by the U.S. Forest Service. The resulting individual tree volume estimates were then expanded through the use of a statistically defined equation to produce the volume estimate for the entire area which includes 192,026 acres and is approximately a 44% the total forested area of the Navajo Nation. A.R.H.

N81-12520*# Purdue Univ., Lafayette, Ind. Applications of Remote Sensing Lab.
CONTEXTUAL CLASSIFICATION OF MULTISPECTRAL IMAGE DATA: APPROXIMATE ALGORITHM
James C. Tilton, Principal Investigator Aug. 1980 18 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E81-10038; NASA-CR-163551; SR-PO-00491; LARS-TR-081580) Avail: NTIS HC A02/MF A01 CSCL 02C

An approximation to a classification algorithm incorporating spatial context information in a general, statistical manner is presented which is computationally less intensive. Classifications that are nearly as accurate are produced. J.M.S.

N81-12521*# Institut National de la Recherche Agronomique, Avignon (France).
THE EVALUATION OF EVAPORATION BY INFRARED THERMOGRAPHY: A CRITICAL ANALYSIS OF THE MEASUREMENTS ON THE CRAU TEST SITE
B. Seguin, V. Petit (Centre d'Informatique Geologique, Fontainbleau, France), R. Devillard, P. Reich, and G. Thouy, Principal Investigators Ispra, Italy Joint Research Centre of the European Communities Jun. 1980 15 p refs In ENGLISH and FRENCH

Sponsored by NASA HCMM
(Proj. TELLUS)
(E81-10039; NASA-CR-163546; Newsletter-16) Avail: NTIS HC A02/MF A01 CSCL 05B

Evapotranspiration was calculated for both the dry and irrigated zone by four methods which were compared with the energy balance method serving as a reference. Two methods did not involve the surface temperature. They are ETR(n) = R(n), liable to be valid under wet conditions and ET(eq) = (delta/delta + gamma) R(n) i.e, the first term of Penman's equation, adapted to moderately dry conditions. The methods using surface temperature were the combined energy balance aerodynamic approach and a simplified approach proposed by Jackson et al. Tests show the surface temperature methods give relatively satisfactory results both in the dry and wet zone, with a precision of 10% to 15% compared with the reference method. As was to be expected, ET(eq) gave satisfactory results only in the dry zone and ET(Rn) in the irrigated zone. Thermography increased the precision in the estimate of ET relative to the most suitable classical method by 5% to 8% and is equally suitable for both dry and wet conditions. The Jackson method does not require extensive ground measurements and the evaluation of the surface roughness. A.R.H.

N81-12522*# Institut National de la Recherche Agronomique, Versailles (France). Station de Bioclimatologie.
A STUDY OF RADIOMETRIC SURFACE TEMPERATURES: THEIR FLUCTUATIONS, DISTRIBUTION AND MEANING
A. Perrier, B. Itier, P. Boissard, Principal Investigators, C. Goillot, P. Belluomo, and P. Valery Ispra, Italy Joint Research Center of the European Communities Feb. 1980 36 p In FRENCH; ENGLISH summary Sponsored by NASA HCMM
(Proj. TELLUS)
(E81-10040; NASA-CR-163544; Newsletter-13) Avail: NTIS HC A03/MF A01 CSCL 05B

A consecutive night and day flight and measurements on the ground, were made in the region of Voves, south of Chartres. The statistical analysis of the thermal scanner data permitted the establishment of criteria for the homogeneity of surfaces. These criteria were used in defining the surface temperature values which are most representative for use in an energy balance approach to evapotranspiration (day) and heat balance (night). For a number of maize fields that airborne thermal scanner data permitted a detailed energy analysis of different fields of a same crop to be carried out. Such a detailed analysis was not necessary for a calculation of crop evapotranspiration which could be evaluated from the mean temperature of the crop surface. A differential analysis day night is of interest for enhancing the contrast between types of surfaces, as well as for a better definition of the daily energy balance. It should be stressed that, for a homogeneous region, a study such as the present one, could be carried out on a relatively small part of the total surface, as the results for a surface of 2.5 x 2 sq km were not significantly different from those obtained from a surface three times larger. A.R.H.

N81-12523*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OVERALL REQUIREMENTS FOR AN ADVANCED UNDERGROUND COAL EXTRACTION SYSTEM
Martin Goldsmith and Milton L. Lavin 15 Oct. 1980 102 p refs
(Contracts NAS7-100; DE-AI01-76ET-12548)
(NASA-CR-163748; JPL-Pub-80-39; DOE/ET-12548/1) Avail: NTIS HC A06/MF A01 CSCL 08I

Underground mining systems suitable for coal seams expoitable in the year 2000 are examined with particular relevance to the resources of Central Appalachia. Requirements for such systems may be summarized as follows: (1) production cost; (2)miner safety; (3) miner health; (4) environmental impact; and (5) coal conservation. No significant trade offs between production cost and other performance indices were found. A.R.H.

N81-12524*# Southwest Research Inst., San Antonio, Tex.
COAL THICKNES3 GUAGE USING RRAS TECHNIQUES, PARTS 2 AND 3 Final Report
J. Derwin King and W. L. Rollwitz Sep. 1980 62 p refs
(Contract NAS8-32606)
(NASA-CR-161607) Avail: NTIS HC A04/MF A01 CSCL 08I

Electron magnetic resonance was investigated as a sensing technique for use in measuring the thickness of the layer of coal overlying the rock substrate. The goal is development of a thickness gauge which will be usable for control of mining machinery to maintain the coal thickness within selected bounds. A sensor must be noncontracting, have a measurement range of 6 inches or more, and an accuracy of 1/2 inch or better. The sensor should be insensitive to variations in spacing between the sensor and the surface, the response speed should be adequate to permit use on continuous mining equipment, and the device should be rugged and otherwise suited for operation under conditions of high vibration, moisture, and dust. Finally, the sensor measurement must not be adversely affected by the natural effects occurring in coal such as impurities, voids, cracks, layering, high moisture level, and other conditions that are likely to be encountered. Author

N81-12525*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
REFERENCE COORDINATE SYSTEMS FOR EARTH DYNAMICS: A PREVIEW
Ivan I. Mueller Aug. 1980 37 p refs Sponsored in part by Deutsche Forschungsgemeinschaft
(Grant NsG-5265; OSURF Proj. 711055)
(NASA-CR-163800; Rept-302) Avail: NTIS HC A03/MF A01 CSCL 08B

Geodynamics is the subject of intensive international research during the last decade. A common requirement for all investigations is the necessity of a well defined coordinate system attached to the Earth in some prescribed way. In addition, a well defined inertial coordinate system is also needed in which the motions of the terrestrial system can be monitored. The problems encountered when establishing such coordinate systems and the transformations between them are presented. In addition, problems related to the modeling of the deformable Earth are discussed. Finally, action items are listed which are necessary to assure that the reference system issue is resolved early and that uniformity is assured by means of international agreements. Author

N81-12526*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PHYSICAL BASIS FOR REMOTE ROCK MAPPING OF IGNEOUS ROCKS USING SPECTRAL VARIATIONS IN THERMAL INFRARED EMITTANCE
Louis S. Walter and Mark L. Labovitz Oct. 1980 30 p refs
(NASA-TM-82019) Avail: NTIS HC A03/MF A01 CSCL 08G

Results of a theoretical investigation of the relation between spectral features in the 8-12 micrometer region and rock type are presented. Data on compositions of a suite of rocks and measurements of their spectral intensities in 8.2-10.9 and 9.4-12.1 micrometer bands published by Vincent (1973) were subjected to various quantitative procedures. There was no consistent direct relationship between rock group names and the relative spectral intensities. However, there is such a relationship between the Thornton-Tuttle (1960) Differentiation Index and the relative spectral intensities. This relationship is explicable on the basis of the change in average Si-O bond length which is a function of the degree of polymerization of the SiO4 tetrahedra of the silicate minerals in the igneous rocks. Author

N81-12527*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGSAT VECTOR MAGNETOMETER CALIBRATION USING MAGSAT GEOMAGNETIC FIELD MEASUREMENTS
E. R. Lancaster, Timothy Jennings, Martha Morrissey, and Robert Langel Nov. 1980 75 p refs
(NASA-TM-82046) Avail: NTIS HC A04/MF A01 CSCL 14B

From the time of its launch on Oct. 30, 1979 into a nearly polar, Sun synchronous orbit, until it reentered the Earth's atmosphere on June 11, 1980, Magsat measured and transmitted more than three complete sets of global magnetic field data. The data obtained from the mission will be used primarily to compute a currently accurate model of the Earth's main magnetic

field, to update and refine world and regional magnetic charts, and to develop a global scalar and vector crustal magnetic anomaly map. The in-flight calibration procecure used for 39 vector magnetometer system parameters is described as well as results obtained from some data sets and the numerical studies designed to evaluate the results. A.R.H.

N81-12528*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVERTING x,y GRID COORDINATES TO OBTAIN LATITUDE AND LONGITUDE IN THE VANDERGRINTEN PROJECTION
David Parry Rubincam Aug. 1980 13 p refs Submitted for publication
(NASA-TM-81998) Avail: NTIS HC A02/MF A01 CSCL 08B

The latitude and longitude of a point on the Earth's surface are found from its x,y grid coordinates in the vanderGrinten projection. The latitude is a solution of a cubic equation and the longitude a solution of a quadratic equation. Also, the x,y grid coordinates of a point on the Earth's surface can be found if its latitude and longitude are known by solving two simultaneous quadratic equations. Author

N81-12529*# National Academy of Sciences - National Research Council, Washington, D. C. *Space Applications Board.*
REMOTE SENSING FOR WATER RESOURCES AND HYDROLOGY. RECOMMENDED RESEARCH EMPHASIS FOR THE 1980'S
1980 30 p refs
(Grant NSR-09-012-106)
(NASA-CR-163791) Avail: NTIS HC A03/MF A01 CSCL 08H

The problems and the areas of activity that the Panel believes should be emphasized in work on remote sensing for water resources and hydrology in the 1980's are set forth. The Panel deals only with those activities and problems in water resources and hydrology that the Panel considers important, and where, in the Panel's opinion, application of current remote sensing capability or advancements in remote sensing capability can help meet urgent problems and provide large returns in practical benefits. L.F.M.

N81-12530# SRI International Corp., Menlo Park, Calif. Artificial Intelligence Center.
A STUDY OF KNOWLEDGE-BASED SYSTEMS FOR PHOTO INTERPRETATION Final Report
Richard O. Duda and Thomas D. Garvey Jun. 1980 67 p refs
(Contract DAAK70-78-C-0114; SRI Proj. 7864)
(AD-A090465; ETL-0235) Avail: NTIS HC A04/MF A01 CSCL 15/4

This report discusses applications of knowledge-based programming techniques to a selection of photo interpretation tasks. The technology of knowledge-based programming is reviewed, several relevant photo interpretation problems are described, and the most promising applications are discussed in detail. Recommendations are presented for developing knowledge-based systems as expert consultant programs to assist military geographic intelligence analysts and to aid users of advanced photo interpretation tools. GRA

N81-12531# Army Engineer Topographic Labs., Fort Belvoir, Va.
DETECTION OF SIGNAL SIGNATURES OF CARTOGRAPHIC FEATURES
Pi-Fuay Chen and William W. Muller Jun. 1980 15 p refs
(AD-A090375) Avail: NTIS HC A02/MF A01 CSCL 08/2

Currently photo interpretation and terrain image identification for military applications is performed manually. This work is time consuming and costly. The work described below is a first step to aiding or semi-automating some of these labor intensive tasks. A semi-automated technique for extracting a selected set of cartographic features such as, road intersections, straight line roads, and rectangular objects from aerial photographs was recently developed at the U.S. Army Engineer Topographic Laboratories (USAETL) using the Walsh transform. The discrete function (Walsh) transform was chosen because of its simplicity (Walsh functions are only two-valved) resulting in simple implementation, and because Walsh functions conform to the selected set of the cartographic features. Since the Walsh transform coefficients were produced by using Walsh functions having alternate magnitudes (either -1 or -1) at different sequences, the Walsh transform coefficients are also decomposed spectral components of the signal signature of the input aerial photographic images. The technique was investigated in two ways as follows: (1) using a 32 by 32 element solid state sensor array to convert aerial imagery into an electronic signal which was processed in a minicomputer to yield Walsh transforms of the image, and (2) a prototype image spectrum analyzer (PISA) was developed which utilizes a large size plasma discharge device (8.5 by 8.5 inch illuminating area with 512 electrodes each in both x and y directions) to generate two dimensional Walsh function patterns, and produce 512 by 512 Walsh coefficients in 14 seconds. GRA

N81-12532# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
A DIGITAL SYSTEMATIC CLASSIFICATION OF ECOSYSTEMS WITH AN ILLUSTRATED SUMMARY OF THE NATURAL VEGETATION OF NORTH AMERICA Final Forest Service General Technical Report
David E. Brown (Arizona Game and Fish Dept.), Charles H. Lowe (Arizona Univ.), and Charles P. Pase Jun. 1980 95 p refs
(PB80-194020; FSGTR/RM-73) Avail: NTIS HC A05/MF A01 CSCL 06F

An increasing need for careful husbandry of the Earth's natural resources renewed interest in the classification and mapping of ecosystems. The inventory of our remaining biotic entities is particularly urgent because the increased aspirations of a constantly growing world population are placing ever greater stress on these generous, but finite, living resources. GRA

N81-12533# University of Southern California, Los Angeles. Dept. of Petroleum Engineering.
CARBON DIOXIDE FOR THE RECOVERY OF CRUDE OIL Annual Report, Nov. 1978 - Nov. 1979
T. M. Doscher Aug. 1980 61 p refs
(Contracts DE-AM03-76SF-00113; EY-76-S-03-0113)
(DOE/SF-0113/4) Avail: NTIS HC A04/MF A01

The ratios of gravitational and viscous forces which exist in tertiary recovery operations, using carbon dioxide as a recovery reagent, were approximated in a scaled physical model at ambient pressure and temperature. The viscosity ratio was now very unfavorable and displacement of moveable water was inefficient. Consequently, the displacement of the residual oil by the solvent, which was simulating the role of carbon dioxide, was also poor. The recovery efficiency could not be improved by reasonable increases in the fluid velocity because the unfavorable mobility caused viscous fingering was so dominant. Insomuch as carbon dioxide flooding, an imperfectly miscible recovery process, these experiments point to the need for imposing a strong measure of mobility control if the injection of carbon dioxide is to achieve widespread usage for the recovery of residual oil. DOE

N81-12534# Battelle Columbus Labs., Ohio.
SORGHUMS AS ENERGY CROPS
E. S. Lipinsky and S. Kresovich 1980 18 p Presented at the BioEnergy World Congress and Exposition, Atlanta, 21-24 Apr. 1980
(Contract W-7405-eng-92)
(CONF-800482-5) Avail: NTIS HC A02/MF A01

The botanical, physiological, and agronomic characteristics of sorghum are described. Integration concepts to improve sorghum prospects are discussed as follows: multiple sweet sorghum crops each year, integration with sugarcane, integration with sugar beets, integration with starch crops, sweet stemmed grain sorghum, and integration with lignocellulosic crops. DOE

N81-12535# Institut National de la Recherche Agronomique, Avignon (France). Centre de Recherches Agronomiques d'Avignon.
CONTRIBUTION TO AGRONOMICAL APPLICATIONS OF REMOTE SENSING: ANALYSIS OF THE RELATIONS BETWEEN THE STRUCTURE OF A VEGETATION COVER-

AGE, ITS PHYSIOLOGICAL STATE, AND RADIOMETRIC DATA [CONTRIBUTION A L'UTILISATION AGRONOMIQUE DE LA TELEDETECTION; ANALYSE DES RELATIONS ENTRE LA STRUCTURE D'UN COUVERT VEGETAL, SON ETAT PHYSIOLOGIQUE, ET LES DONNEES RADIOMETRIQUES]
Frederic Baret and Martine Huet Sep. 1979 133 p refs In FRENCH
Avail: NTIS HC A07/MF A01

Quantitative relations between reflectance measurements and the physiological state of plants were studied. The biological aspects of wheat growth are recalled. The measurement of the spectral characteristics of the light reflected by leaves is described together with the parameters most representative of the plant's state. The radiometric measurement techniques employed are presented together with the factors to be taken into consideration (Sun's altitude, cloud covering, wind and optical characteristics of the soil). Theoretical models are employed. The results given concern varieties of wheat and barely. The usefulness of the technqiue is demonstrated. Author (ESA)

N81-12536# European Space Agency, Paris (France).
REMOTE SENSING METHODS FOR THE DETERMINATION OF SLANT RANGE VISIBILITY
Christian Werner Jun. 1980 93 p refs Transl. into ENGLISH of 'Fernmessmethoden zur Bestimmung der Schraegsichtweite', DFVLR, Oberpfaffenhofen, West German Report DFVLR-FB-79-14, Mar. 1979 Original report in GERMAN previously announced as N80-23759 Original German report available from DFVLR, Cologne DM 8,70
(ESA-TT-627; DFVLR-FB-79-14) Avail: NTIS HC A03/MF A01

The various known methods for the determination of the slant visual range are reviewed and compared. Emphasis is placed on a discussion of laser radar systems for use in aircraft landing operations. Based on considerations related to accuracy and technical complexity, a measurement method is proposed for visibility distances of up to 1500 m and altitudes of 100 m.
Author (ESA)

N81-12537# Thomson-CSF, Paris (France). Dept. Espace Satellites.
PHASE A STUDY OF SAR FOR THE EUROPEAN REMOTE SENSING PROGRAMME: ADDITIONAL STUDIES. EXECUTIVE SUMMARY Final Report
23 Jun. 1980 17 p Prepared in cooperation with Dornier System, Friedrichshafen, West Germany
(Contract ESA-4226/80/F/CG(SC))
(ESA-CR(P)-1375) Avail: NTIS HC A02/MF A01

Modifications or improvements of a synthetic aperture radar remote sensing satellite are discussed. Derivation of radar performances at non-optical incidence angles in environment research satellite orbit, performance calculations at different incident angles in shuttle orbit, consequences on the mean RF power for improved gray level resolution, absolute and relative accuracies on ground reflectivity estimate, and antenna tilting configuration and mechanism concepts are considered.
Author (ESA)

N81-12538# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.
AN IMPROVED FEATURE SELECTION CRITERION AND ITS APPLICATION TO MULTISPECTRAL REFLECTANCE DATA FROM CROPS
W. Verhoef Jan. 1979 68 p refs
(NLR-TR-79002-U) Avail: NTIS HC A04/MF A01

Spectral reflectance data from various crops, obtained with a field spectrometer throughout the growing season of 1974 at Wageningen were processed in order to investigate the information content of spectral channels and synthetic features. A measure of information content is developed by considering the contribution of a subset of features to the total variance in a transformed feature space which is whitened for within-class variations. The usefulness of principal component analysis for data reduction purposes is questioned and the omission of some of the original spectral chennels is recommended. Based upon the proposed measure of information content and under the constraint that the loss of information is not greater than 5 percent, it is shown that for crop discrimination only three channels can be deleted from an a priori selected set of twelve channels in the wavelength region from 400 to 2300 nm. Author (ESA)

N81-12539# Royal Aircraft Establishment, Farnborough (England).
A CARTOGRAPHIC COMPUTER DATA FORMAT AND ASSOCIATED PROGRAMS
A. H. Benny London HMSO Mar. 1980 67 p refs
(RAE-TR-80037; RAE-Space-578; BR74346) Avail: NTIS HC A04/MF A01

A map data format is described in detail, together with a suite of computer programs and subroutines for handling such data files. This format is used for storage of LANDSAT multispectral images. A map data file consists of a header record followed by a number of features, each feature consisting of either one coordinate valve (to represent a single location, or a string of coordinates (to represent a line). Programs are described to create, alter, transform, and display map files. Author (ESA)

N81-12540# World Meteorological Organization, Geneva (Switzerland).
TECHNICAL REGULATIONS: HYDROLOGY AND INTERNATIONAL HYDROLOGICAL CODES
1980 117 p
(WMO-555; ISBN-92-63-10555-3) Avail: NTIS HC A06/MF A01

Practices and procedures in operational hydrology are given, related to the classification of hydrological observing stations, their location and observing programs, collection, processing and publication of hydrological data, and preparation of forecasts and warnings. Author (ESA)

N81-12541# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF AGRICULTURAL RESOURCES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Oct. 1973 - Sep. 1980
Audrey S. Hundemann Oct. 1980 270 p Supersedes NTIS/PS-79/0993; NTIS/PS-78/0969
(PB80-814981; NTIS/PS-79/0993; NTIS/PS-78/0969) Avail: NTIS HC $30.00/MF $30.00 CSCL 02C

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resources assessment. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-12542* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL SYSTEM HAVING ALTERNATING CURRENT OUTPUT Patent
John C. Evans, Jr., inventor (to NASA) Issued 12 Aug. 1980 6 p Filed 10 Aug. 1979 Continuation-in-part of abandoned US Patent Appl. SN-915050, filed 9 Jun. 1978
(NASA-Case-LEW-12806-2; US-Patent-4,217,633; US-Patent-Appl-SN-065676; US-Patent-Class-363-27; US-Patent-Class-136-249; US-Patent-Class-136-291; US-Patent-Class-363-60; US-Patent-Class-363-147; US-Patent-Appl-SN-915050) Avail: US Patent and Trademark Office CSCL 10A

A monolithic multijunction solar cell was modified by fabricating an integrated circuit inverter on the back of the cell to produce a device capable of generating an alternating current

output. In another embodiment, integrated curcuit power conditioning electronics was incorporated in a module containing a solar cell power supply.

Official Gazette of the U.S. Patent and Trademark Office

N81-12543*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

SATELLITE POWER SYSTEM CONCEPT DEVELOPMENT AND EVALUATION PROGRAM. VOLUME 1: TECHNICAL ASSESSMENT SUMMARY REPORT

Nov. 1980 116 p refs

(NASA-TM-58232) Avail: NTIS HC A06/MF A01 CSCL 10A

Candidate satellite power system (SPS) concepts were identified and evaluated in terms of technical and cost factors. A number of alternative technically feasible approaches and system concepts were investigated. A reference system was defined to facilitate economic, environmental, and societal assessments by the Department of Energy. All elements of the reference system were defined including the satellite and all its subsystems, the orbital construction and maintenance bases, all elements of the space transportation system, the ground receiving station, and the associated industrial facilities for manufacturing the required hardware. The reference conclusions and remaining issues are stated for the following topical areas: system definition; energy conversion and power management; power transmission and reception; structures, controls, and materials; construction and operations; and space transportation. R.C.T.

N81-12544*# Dayton Univ., Ohio.

SOLAR HEATING AND COOLING SYSTEM INSTALLED AT COLUMBUS, OHIO Final Report

Sep. 1980 173 p Sponsored by NASA. Marshall Space Flight Center Prepared in cooperation with Columbus Technical Inst., Ohio

(Contract EG-77-A-01-4090)

(NASA-CR-161589) Avail: NTIS HC A08/MF A01 CSCL 10A

The Solar Energy System was installed as a part of a new construction of a college building. The building will house classrooms and laboratories, administrative offices and three lecture halls. The Solar Energy System consists of 4,096 square feet (128 panels) Owens/Illinois Evacuated Glass Tube Collector Subsystem, and a 5,000 gallon steel tank below ground storage system. Hot water is circulated between the collectors and storage tank, passing through a water/lithium bromide absorption chiller to cool the building. L.F.M.

N81-12545*# Dayton Univ., Ohio.

SOLAR HEATING SYSTEM INSTALLED AT TROY, OHIO Final Report, Jul. 1976 - Nov. 1979

Sep. 1980 221 p Sponsored in part by NASA, Daytona Association of Plumbing Contractor, City of Troy, Concord Township, Troy Foundation

(Contract EX-76-C-01-2375)

(NASA-CR-161588) Avail: NTIS HC A10/MF A01 CSCL 10A

The completed system was composed of three basic subsystems: the collector system consisting of 3,264 square feet of Owens Illinois evacuated glass tube collectors; the storage system which included a 5,000 gallon insulated steel tank; and the distribution and control system which included piping, pumping and heat transfer components as well as the solemoid activated valves and control logic for the efficient and safe operation of the entire system. This solar heating system was installed in an existing facility and was, therefore, a retrofit system. Extracts from the site files, specifications, drawings, installation, operation and maintenance instructions are included. Author

N81-12546*# STD Research Corp., Arcadia, Calif.

ANALYTICAL INVESTIGATION OF CRITICAL PHENOMENA IN MHD POWER GENERATORS Final Report

31 Jul. 1980 375 p refs

(Contracts DEN3-179; SC-77-AA-012674)

(NASA-CR-165143; DOE/NASA/0179-1; STDR-80-22) Avail: NTIS HC A16/MF A01 CSCL 10A

Critical phenomena in the Arnold Engineering Development Center (AEDC) High Performance Demonstration Experiment (HPDE) and the U.S. U-25 Experiment, are analyzed. The performance of a NASA specified 500 MW(th) flow train is analyzed. Critical phenomena analyzed include: Hall voltage overshoots; optimal load schedules; parametric dependence of the electrode voltage drops; boundary layer behavior; near electrode phenomena with finite electrode segmentation; current distribution in the end regions; scale up rules; optimum Mach number distribution; and the effects of alternative cross sectional shapes. R.C.T.

N81-12547*# BDM Corp., McLean, Va.

POINT FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECT. VOLUME 1: EXECUTIVE SUMMARY

Karen E. Landis, ed. 1979 97 p refs Workshop for Potential Military and Civil Users of Small Solar Thermal Elec. Power Technol., McLean, Va., 11-14 Sep. 1979 Sponsored in part by DOE Prepared for JPL

(Contract JPL-955354)

(NASA-CR-163803) Avail: NTIS HC A05/MF A01 CSCL 10A

Background and objectives used for the Workshop for Potential Military and Civil Users for Small Solar Thermal Electric Power Technologies are discussed. A summary of the results and conclusions developed at the workshop regarding small solar thermal electric power technologies is included. S.F.

N81-12548*# BDM Corp., McLean, Va.

POINT FOCUSING THERMAL AND ELECTRIC APPLICATIONS PROJECT. VOLUME 2: WORKSHOP PROCEEDINGS

Karen E. Landis, ed. 1979 241 p refs Workshop for Potential Military and Civil Users of Small Solar Thermal Elec. Power Technol., McLean, Va., 11-14 Sep. 1979 Sponsored in part by DOE Prepared for JPL Original contains color illustrations

(Contract JPL-955354)

(NASA-CR-163804) Avail: NTIS HC A11/MF A01 CSCL 10A

Point focus distributed receiver solar thermal technology for the production of electric power and of industrial process heat is discussed. Thermal power systems are described. Emphasis is on the development of cost effective systems which will accelerate the commercialization and industrialization of plants, using parabolic dish collectors. The characteristics of PFDR systems and the cost targets for major subsystems hardware are identified. Markets for this technology and their size are identified, and expected levelized bus bar energy costs as a function of yearly production level are presented. The present status of the technology development effort is discussed. S.F.

N81-12549*# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.

THE DEVELOPMENT OF A METHOD OF PRODUCING ETCH RESISTANT WAX PATTERNS ON SOLAR CELLS Final Report

E. Pastirik Nov. 1980 32 p refs

(Contract JPL-955324; JPL Proj. 2365)

(NASA-CR-163806; Rept-2365/4; DOE/JPL-955324-80/4; JPL-9950-448) Avail: NTIS HC A03/MF A01 CSCL 10A

A potentially attractive technique for wax masking of solar cells prior to etching processes was studied. This technique made use of a reuseable wax composition which was applied to the solar cell in patterned form by means of a letterpress printing method. After standard wet etching was performed, wax removal by means of hot water was investigated. Application of the letterpress wax printing process to silicon was met with a number of difficulties. The most serious shortcoming of the process was its inability to produce consistently well-defined printed patterns on the hard silicon cell surface. Author

N81-12550*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

AN INDUSTRIAL APPLICATION OF THE JPL ACTS WITH ENERGY RECOVERY

Marshall F. Humphrey, George E. Wilson (Eutek, Inc., Sacramento, Calif.), and Terry W. Schroepfer (Eutek, Inc., Sacramento, Calif.) 23 Sep. 1980 49 p refs

(Contract NAS7-100)

(NASA-CR-163807; JPL-9950-449) Avail: NTIS

HC A03/MF A01 CSCL 10A

The JPL Activated Carbon Treatment System (ACTS) uses sewage solids derived from municipal wastewater treatment systems as a source of organic material for powdered activated carbons (PAC). The PAC is used for the COD removal from wastewater and as a filter aid in the recovery of additional sewage solids. L.F.M.

N81-12551*# Dow Corning Corp., Midland, Mich. Solid-State Research and Development Lab.

SOLAR SILICON VIA THE DOW CORNING PROCESS Final Report

L. P. Hunt and V. D. Dosaj Oct. 1979 106 p refs Sponsored by NASA and DOE Prepared for JPL

(Contract JPL-954559)

(NASA-CR-163798; DOE/JPL-954559-78/7; JPL-9950-452)

Avail: NTIS HC A06/MF A01 CSCL 10A

Technical feasibility for high volume production of solar cell-grade silicon is investigated. The process consists of producing silicon from pure raw materials via the carbothermic reduction of quartz. This silicon was then purified to solar grade by impurity segregation during Czochralski crystal growth. Commercially available raw materials were used to produce 100 kg quantities of silicon during 60 hour periods in a direct arc reactor. This silicon produced single crystalline ingot, during a second Czochralski pull, that was fabricated into solar cells having efficiencies ranging from 8.2 percent to greater than 14 percent. An energy analysis of the entire process indicated a 5 month payback time. S.F.

N81-12552*# Solarex Corp., Rockville, Md.

PHASE 2 OF THE ARRAY AUTOMATED ASSEMBLY TASK FOR THE LOW COST SILICON SOLAR ARRAY PROJECT Final Report

Raymond C. Petersen Nov. 1980 107 p refs Sponsored by JPL and DOE

(NASA-CR-163805; DOE/JPL-954854-80/8; JPL-9950-450)

Avail: NTIS HC A06/MF A01 CSCL 10A

Studies were conducted on several fundamental aspects of electroless nickel/solder metallization for silicon solar cells. A process, which precedes the electroless nickel plating with several steps of palladium plating and heat treatment, was compared directly with single step electroless nickel plating. Work was directed toward answering specific questions concerning the effect of silicon surface oxide on nickel plating, effects of thermal stresses on the metalliztion, sintering of nickel plated on silicon, and effects of exposure to the plating solution on solar cell characteristics. The process was found to be extremely lengthy and cumbersome, and was also found to produce a product virtually identical to that produced by single step electroless nickel plating, as shown by adhesion tests and electrical characteristics of cells under illumination. Author

N81-12553*# Optical Coating Lab., Inc., City of Industry, Calif. Photoelectronics Div.

DEVELOPMENT OF HIGH EFFICIENCY (14 PERCENT) SOLAR CELL ARRAY MODULE Final Report, Nov. 1979 - Jun. 1980

P. A. Iles, S. Khemthong, S. Olah, W. J. Sampson, and K. S. Ling Jun. 1980 61 p refs Sponsored in part by DOE

(Contract JPL-955217)

(NASA-CR-163808; DOE/JPL-955217-80/5; JPL-9950-445)

Avail: NTIS HC A04/MF A01 CSCL 10A

Most effort was concentrated on development of procedures to provide large area (3 in. diameter) high efficiency (16.5 percent AM1, 28 C) P+NN+ solar cells. Intensive tests with 3 in. slices gave consistently lower efficiency (13.5 percent). The problems were identified as incomplete formation of and optimum back surface field (BSF), and interaction of the BSF process and the shallow P+ junction. The problem was shown not to be caused by reduced quality of silicon near the edges of the larger slices. Author

N81-12554*# Applied Solar Energy Corp., City of Industry, Calif.

THIRD GENERATION DESIGN SOLAR CELL MODULE LSA TASK 5, LARGE SCALE PRODUCTION Final Report

Aug. 1980 43 p refs Sponsored in part by DOE

(Contract JPL-955409)

(NASA-CR-163809; DOE/JPL-955409-80/1; JPL-9950-444)

Avail: NTIS HC A03/MF A01 CSCL 10A

A total of twelve (12) preproduction modules were constructed, tested, and delivered. A concept to the frame assembly was designed and proven to be quite reliable. This frame design, as well as the rest of the assembly, was designed with future high volume production and the use of automated equipment in mind. Author

N81-12555# Committee on Interstate and Foreign Commerce (U. S. House).

PRIORITY ENERGY PROJECT ACT OF 1979

Washington GPO 1980 253 p refs Hearings on H. R. 4499, H. R. 4573, and H. R. 4862 before the Comm. on Interstate and Foreign Com., 96th Congr., 1st Sess., 18 and 20 Jul. 1979

(GPO-58-154) Avail: Subcommittee on Energy and Power

Legislation is proposed to hasten and simplify the procedure for Federal approval of nonnuclear energy facilities. Development of synthetic fuels and synthetic chemical feedstocks is stressed. S.F.

N81-12556# Naval Research Lab., Washington, D. C. Marine Technology Div.

OTEC COLD WATER PIPE DESIGN FOR PROBLEMS CAUSED BY VORTEX-EXCITED OSCILLATIONS Final Report

Owen M. Griffin 14 Mar. 1980 147 p refs Sponsored in part by NOAA Backup document for AIAA Synoptic scheduled for publication in Journal of Energy in Jan. - Feb. 1981

(NRL Proj. 0275-A-0)

(NRL-MR-4157; LOG-E421) Avail: NTIS HC A07/MF A01

The problems of vortex shedding from bluff, flexible structures in steady currents and the resulting vortex excited oscillations are investigated. The effects of flow nonuniformities, surface roughness of the cylinder, and inclination to the incident flow are considered in addition to the case of a smooth cylinder in a uniform stream. Emphasis is placed upon design procedures, hydrodynamic coefficients applicable in practice, and the specification of structural response parameters relevant to the OTEC cold water pipe. J.M.S.

N81-12557# Committee on Energy and Natural Resources (U.S. Senate).

THE WESTERN HEMISPHERE ENERGY SYSTEM

Melvin A. Conant Washington GPO 1979 163 p refs Rept. presented to the Comm. on Energy and Nat. Resources, 96th Congr., 1st Sess., Nov. 1979

(GPO-51-683; PUBL-96-45) Avail: Committee on Energy and Natural Resources

Oil exploration and production by the Western Hemisphere countries of Mexico, Venezuela, Canada and the United States are discussed. International cooperation in developing shale oil, tar sands and heavier oils is presented as an alternative to the current energy dependent state. S.F.

N81-12558*# Rice Univ., Houston, Tex.

SOLAR POWER SATELLITE OFFSHORE RECTENNA STUDY Final Report

Nov. 1980 252 p refs Prepared in cooperation with Brown and Root Development, Inc. and Arthur D. Little, Inc.

(Contract NAS8-33023)

(NASA-CR-3348) Avail: NTIS HC A12/MF A01 CSCL 10A

It was found that an offshore rectenna is feasible and cost competitive with land rectennas but that the type of rectenna which is suitable for offshore use is quite different from that specified in the present reference system. The result is a nonground plane design which minimizes the weight and greatly reduces the number of costly support towers. This preferred design is an antenna array consisting of individually encapsulated dipoles with reflectors supported on feed wires. Such a 5 GW rectenna could be built at a 50 m water depth site to withstand hurricane and icing conditions for a one time cost of 5.7 billion dollars. Subsequent units would be about 1/3 less expensive. The east coast site chosen for this study represents an extreme case of severe environmental conditions. More benign and more shallow water sites would result in lower costs. Secondary uses such as

mariculture appear practical with only minor impact on the rectenna design. The potential advantages of an offshore rectenna, such as no land requirements, removal of microwave radiation from populated areas and minimal impact on the local geopolitics argue strongly that further investigation of the offshore rectenna should be vigorously pursued. Author

N81-12559*# National Aeronautics and Space Administration, Washington, D. C.
ENERGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Jul. 1979 546 p
(NASA-SP-7043(22)) Avail: NTIS HC A23/MF A01 CSCL 10B

This bibliography lists 1096 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System from April 1, 1979 through June 30, 1979. Author

N81-12560*# Rockwell International Corp., Columbus, Ohio. Space Operations and Satellite Systems Div.
SATELLITE POWER SYSTEM (SPS) LASER STUDIES. VOLUME 2: METEOROLOGICAL EFFECTS ON LASER BEAM PROPAGATION AND DIRECT SOLAR PUMPED LASERS FOR THE SPS Final Report
R. E. Beverly, III Columbus, Ohio NASA Nov. 1980 143 p refs
(Contract NAS8-32475)
(NASA-CR-3347; SSD-80-0119-2-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 10A

The primary emphasis of this research activity was to investigate the effect of the environment on laser power transmission/reception from space to ground. Potential mitigation techniques to minimize the environment effect by a judicious choice of laser operating parameters was investigated. Using these techniques, the availability of power at selected sites was determined using statistical meteorological data for each site. Author

N81-12561# Committee on Agriculture, Nutrition, and Forestry (U. S. Senate).
AGRICULTURAL WASTE PRODUCTS AS ALTERNATIVE ENERGY SOURCES
Washington GPO 1980 77 p Hearing before the Subcomm. on Agr. Res. and Gen. Legislation of the Comm. on Agr., Nutrition, and Forestry, 96th Congr., 2nd Sess., 21 Mar. 1980, Tallahassee, Fla.
(GPO-62-991) Avail: Subcommittee on Agricultural Research and General Legislation

The hearings before the Senate Subcommitte on Agricultural Research and General Legislation concerning the utilization of agricultural waste products as energy sources are presented. The production of biomass derived fuels, particularly alcohol, is discussed with regard to its technical and economic feasibility. Attention is also given to the problems relating to the use of gasohol. M.G.

N81-12562# Committee on Agriculture, Nutrition, and Forestry (U. S. Senate).
ENERGY RESEARCH AND EXTENSION
Washington GPO 1980 59 p Hearing before the Subcomm. on Agr. Res. and Gen. Legislation of the Comm. on Agr., Nutrition, and Forestry, 96th Congr., 2nd Sess., 11 Mar. 1980
(GPO-61-544) Avail: Subcommittee on Agricultural Research and General Legislation

The role of energy research and extension activities in the development of alternative energy technology is discussed. The impact of alcohol fuels upon the future of the agricultural community was examined. T.M.

N81-12563# Committee on Public Works and Transportation (U. S. House).
REVIEW OF TITLE 5 OF THE NATIONAL ENERGY CONSERVATION POLICY ACT
Washington GPO 1980 244 p Hearings before the Subcomm. on Public Buildings and Grounds of the Comm. on the Public Works and Transportation, 96th Congr., 1st Sess., 26-27 Sep. 1979
(GPO-57-523) Avail: Subcommittee on Public Buildings and Grounds

The administration's efforts and achievements in implementing PL 95-619 are reviewed with emphasis on those sections of the energy policy dealing with the development, demonstration and promotion of energy conservation, the use of solar heating and solar cooling and other renewable energy sources in Federal buildings, and the acquisition of photovoltaic solar electric systems for electric production in Federal facilities. A.R.H.

N81-12564*# Little (Arthur D.), Inc., Cambridge, Mass.
GaAlAs/GaAs SOLAR CELL PROCESS STUDY Final Report
David W. Almgren and Katinka I. Csigi Washington NASA Dec. 1980 160 p refs
(Contract NAS1-15516)
(NASA-CR-3361; ADL-82340) Avail: NTIS HC A08/MF A01 CSCL 10A

Available information on liquid phase, vapor phase (including chemical vapor deposition) and molecular beam epitaxy growth procedures that could be used to fabricate single crystal, heteroface, (AlGa) As/GaAs solar cells, for space applications is summarized. A comparison of the basic cost elements of the epitaxy growth processes shows that the current infinite melt LPE process has the lower cost per cell for an annual production rate of 10,000 cells. The metal organic chemical vapor deposition (MO-CVD) process has the potential for low cost production of solar cells but there is currently a significant uncertainty in process yield, i.e., the fraction of active material in the input gas stream that ends up in the cell. Additional work is needed to optimize and document the process parameters for the MO-CVD process. Author

N81-12565# Committee on Commerce, Science, and Transportation (U. S. Senate).
OCEAN THERMAL ENERGY CONVERSION ACT OF 1980
GPO 1980 167 p refs Hearings on S. 2492 before the Comm. on Com., Sci. and Transportation, 96th Congr., 2nd Sess., 10 Apr. and 1 May 1980
(GPO-64-551) Avail: Committee on Commerce, Science and Transportation

The hearings before the Senate Committee on Commerce, Science, and Transportation concerning the Ocean Thermal Energy Conversion Act of 1980 are presented. The text of the bill is given. It proposes to regulate commerce, promote energy self sufficiency, and protect the environment by establishing procedures for the location, construction, and operation of ocean thermal energy conversion facilities and plantships to produce electricity and energy intensive products off the coasts of the United States. M.G.

N81-12566# Committee on Science and Technology (U. S. House).
ENERGY FROM MUNICIPAL SOLID WASTES
Paul F. Rothberg Washington GPO 1980 30 p refs Rept. presented by the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Jun. 1980 Prepared by Congressional Research Service, Library of Congress
(GPO-61-252) Avail: SOD HC

A summary of the hearings before the House Subcommittee on Energy Development and Applications concerning the utilization of municipal solid wastes as an energy source is given. The processes available to convert solid wastes into energy are reviewed as well as the problems and opportunities associated with commercialization of these products. M.G.

N81-12567# Committee on Science and Technology (U. S. House).
OVERSIGHT OF ENERGY DEVELOPMENT IN AFRICA AND THE MIDDLE EAST
Washington GPO 1980 135 p Presented to the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., Apr. 1980
(GPO-60-580) Avail: SOD HC

Energy development in South Africa, Nigeria, the Ivory Coast and Saudi Arabia is discussed. Synthetic fuels, coal liquefaction, solar energy and ocean thermal energy conversion are emphasized. S.F.

N81-12568# *Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

THE CHARGE AND DISCHARGE BEHAVIOR OF MOLYBDENUM TRIOXIDE ELECTRODES IN LITHIUM PERCHLORATE PROPYLENE CARBONATE ELECTROLYTE

Herbert F. Hunger and Joseph E. Ellison Jul. 1980 25 p refs (DA Proj 1L1-61102-AH-47)

(AD-A090346; DELET-TR-80-15) Avail: NTIS HC A02/MF A01 CSCL 10/3

The anodic and cathodic behavior of molybdenum trioxide electrodes in various states of lithiation was investigated in 1M LiClO4-PC electrolytes at room temperature. A comparison was made between the anodic and cathodic rate capabilities of the electrodes. From cycling experiments at various depths of discharge, cycle life data were obtained. Problems observed after deep discharges are discussed. GRA

N81-12569# Army Mobility Equipment Command, Fort Belvoir, Va.

THE ADSORPTION AND ELECTROOXIDATION OF SIMPLE HYDROCARBONS FOR DIRECT OXIDATION HYDROCARBON AIR FUEL CELLS

Amos J. Coleman Jun. 1980 13 p refs

(AD-A090377) Avail: NTIS HC A02/MF A01 CSCL 10/2

The development of new and more sophisticated tactical weapon systems mandates that reliable electrical power sources are also available. The ideal tactical power source should be silent, lightweight and mobile. A fuel cell system would meet these requirements. Hydrogen-air fuel cells are now being considered for deployment for the near future. In order to obtain hydrogen rich mixtures for fuels, these fuel cell systems must be equipped with one of the following: hydrogen storage devices, thermal crackers, steam reformers, or partial oxidizers. A direct oxidation hydrocarbon-air fuel cell would be more attractive, since it would eliminate the above items and result in a lighter, less complex system. A fuel cell system which would operate interchangeably on a variety of fuels would be added benefit. This report describes the research effort at MERADCOM to develop such a system. The overall objective is to provide the basic information required for the development of a direct oxidation hydrocarbon-air fuel cell. GRA

N81-12570# Institute of Gas Technology, Chicago, Ill. Engineering and Science Research Dept.

WASTES AND BIOMASS AS ENERGY RESOURCES

Donald L. Klass 1979 15 p refs Presented at the 14th World Gas Conf., Toronto, 27 May - 1 Jun. 1979

(CONF-790512-1) Avail: NTIS HC A02/MF A01

Organic fuels can be manufactured by converting major sources of continuously renewable nonfossil carbon to synfuels that are interchangeable with, or can be substituted for, natural gas and petroleum-derived fuels. Promising sources of this carbon are waste materials, such as urban refuse, and biomass produced from solar energy by photosynthesis. The development of this concept is presented in this paper. The broad scope of the technology and its potential impact on energy supplies are reviewed. The renewable feature of both wastes and biomass makes them valuable natural resources that inevitably will be fully developed and commercialized as sources of energy-intensive products and synfuels. The perpetual availability of organic fuels will permit the conservation of valuable fossil fuel reserves, and, as time passes, offer a long-term solution to independence from foreign energy supplies and fossil fuel depletion. Author

N81-12571# Union Carbide Corp., Tonawanda, N.Y. Linde Div.

INSULATION DEVELOPMENT FOR HIGH-TEMPERATURE BATTERIES FOR ELECTRIC VEHICLE APPLICATION Final Report, 1 Oct. 1978 - 30 Nov. 1979

Dec. 1979 114 p refs

(Contract EM-78-C-01-5160)

(CONS-5160-T1) Avail: NTIS HC A06/MF A01

A high performance, vacuum insulation capable of withstanding 15 psi plus battery loading with low compression and operating in the 660 to 840 F range is to be developed. The insulation would allow construction of rectangular, lightweight and low cost, vacuum insulated enclosures for electric vehicles using Na/S or Li/MS batteries. E.D.K.

N81-12572# Midwest Research Inst., Golden, Colo.

US DEPARTMENT OF ENERGY SOLAR THERMAL ENERGY SYSTEMS PROGRAM. AN OVERVIEW PRESENTATION

G. W. Braun 1980 38 p refs Presented at Solar Energy Industries Assoc. Meeting, San Jose, Calif., 9 Aug. 1979

(Contract DE-AC02-77CH-00178)

(SERI/SP-733-526; CONF-7908122-1) Avail: NTIS HC A03/MF A01

Intended as both a position paper and a progress report to industry, a comprehensive overview of the US Department of Energy's Solar Thermal Program is provided. Cost goals, systems design parameters, applications considerations, and the potential for industry involvement in solar thermal development and commercialization are described in detail. Decentralized management of R & D functions is linked to priorities and strategies of the evolving program. DOE

N81-12573# Midwest Research Inst., Golden, Colo.

OPEN CYCLE OTEC SYSTEM WITH FALLING JET EVAPORATOR AND CONDENSER

A. Kogan, D. H. Johnson, H. J. Green, and D. A. Olson Jul. 1980 11 p refs Presented at 7th Ocean Energy Conf., Washington, D.C., 2 Jun. 1980

(Contract DE-AC02-76CH-00178)

(SERI/TP-631-791; CONF-800633-3) Avail: NTIS HC A02/MF A01

A configuration for the open cycle (OC) Ocean Thermal Energy Conversion (OTEC) system is presented incorporating a countercurrent falling jet evaporator and a concurrent falling jet condenser. The parameters governing performance of the proposed configuration are discussed and the sizing of equipment for a 100 MWe net power output OC OTEC plant is performed, based on recent experimental falling jet heat and mass transfer results. The performance of an OC OTEC plant with falling jet evaporatocondenser is compared with the Westinghouse conceptual design that uses an open channel evaporator and a surface condenser. Preliminary calculations indicate that falling jet heat and mass transfer, when applied in the proposed configuration, leads to a very simple and compact plant assembly resulting in substantial capital cost savings. DOE

N81-12574# Midwest Research Inst., Golden, Colo.

INVESTIGATION OF SIMPLE DAILY SOLAR RADIATION MODELS SUITABLE FOR USE IN THE DESIGN OF SOLAR HEATING SYSTEMS

S. Sillman Aug. 1980 50 p refs

(SERI/RR-721-675) Avail: NTIS HC A03/MF A01

Solar heating system simulations typically require hourly weather data and the use of a main line computer. A simpler alternative is to use daily steps with a model for daily solar collection. The accuracy of sinusoidal radiation models for use in solar heating simulation is investigated. Accuracy of daily radiation models is assessed in two ways: by a theoretical comparison with hourly weather data, and by analysis of results of daily simulation. Results indicate that a daily radiation model can be designed with errors of less than 2 percent. DOE

N81-12575# Midwest Research Inst., Golden, Colo.

SYSTEMS ANALYSIS OF THERMAL STORAGE

R. J. Copeland Aug. 1980 6 p refs Presented at 5th Ann. Thermal Storage Meeting, McLean, Va., 10 Oct. 1980

(Contract DE-AC02-77CH-00178)

(SERI/TP-631-841; CONF-801055-1) Avail: NTIS HC A02/MF A01

Analyses were conducted on thermal storage concepts for solar thermal applications. These studies include both estimates of the obtainable costs of thermal storage concepts and their worth to a user (i.e., value). Based on obtainable costs and performance, promising thermal storage concepts are being identified. A preliminary screening was completed and a more indepth study was initiated. Value studies are being conducted to establish cost goals. A ranking of storage concepts based on value in solar thermal electric plants was conducted for both diurnal and long duration applications. Ground mounted thermal

storage concepts for a parabolic dish/Stirling system are also being evaluated. DOE

N81-12576# Midwest Research Inst., Golden, Colo.
ANNUAL-CYCLE THERMAL ENERGY STORAGE FOR A COMMUNITY SOLAR SYSTEM: DETAILS OF A SENSITIVITY ANALYSIS
F. Baylin, R. Monte, and S. Sillman Jul. 1980 88 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-721-575) Avail: NTIS HC A05/MF A01

Results and conclusions of a simulation and sensitivity analysis of community sized, annual cycle thermal energy storage (ACTES) solar energy systems. A total of 440 systems were sized for 10 locations in the United States. Three different building types and four different community sizes were modeled. All designs used each of two collector types at each of two different tilt angles. Two linear relationships were derived which simplify system sizing. The average ambient temperature is used to determine average yearly collector efficiency. This parameter combined with estimates of space/DHW loads, storage/distribution losses, and total yearly insolation per square meter allows estimation of collector area. Storage size can be estimated from the winter net load which is based on space and DHW loads, storage and distribution losses, and collector solar heat gain for the winter months. DOE

N81-12577# Acurex Corp., Mountain View, Calif. Alternate Energy Div.
DEVELOPMENT OF A LOW-COST SOLAR PANEL USING LAMINATED POLYMER FILMS Final Report, 15 Sep. 1977 - 15 Nov. 1978
E. V. Nelson, G. J. Adams, W. Elkins, and A. H. McLeod Mar. 1980 116 p refs
(Contract EG-77-C-04-4121)
(ALO-4121-2) Avail: NTIS HC A06/MF A01

The Low Cost Solar Panel development program demonstrate the fabrication of an inexpensive single glazed, nonconcentrating solar collector. With fabrication of a prototype version of the LCSP, the following key conclusions are reached: (1) the LCSP can provide cost effective thermal energy in the near term due to low collector cost, low shipping and installation costs, and high performance; (2) the LCSP concept can be rapidly commercialized since the required manufacturing technology already exists, and the capital cost for equipment would be relatively low; and (3) the LCSP concept is technically feasible; however, additional engineering and manufacturing development are required to reach the point of commercialization. S.F.

N81-12578# Midwest Research Inst., Golden, Colo.
SOLAR ENERGY IN AUSTRALIA: A PROFILE OF RENEWABLE ENERGY ACTIVITY IN ITS NATIONAL CONTEXT
Glenna L. Case Aug. 1980 83 p refs
(Contract DE-AC02-77CH-00178)
(SERI/SP-763) Avail: NTIS HC A05/MF A01

The development of solar energy technology in Australia is examined. The following topics are included: country overview; energy summary; geopolitical, economic, and cultural aspects of Australia; the energy profile; and international agreements, contacts, manufacturers, and projects. DOE

N81-12579# University of Southeastern Massachusetts, North Dartmouth.
GEOTHERMAL ENERGY AS A SOURCE OF ELECTRICITY. A WORLDWIDE SURVEY OF THE DESIGN AND OPERATION OF GEOTHERMAL POWER PLANTS
R. DiPippo Jan. 1980 377 p refs
(Contract DE-AS02-76ET-28320)
(DOE/RA-28320/1) Avail: NTIS HC A17/MF A01

An overview of geothermal power generation is presented. A survey of geothermal power plants is given for the following countries: China, El Salvado, Iceland, Italy, Japan, Mexico, New Zealand, Philippines, Turkey, USSR, and USA. A survey of countries planning geothermal power plants is included. DOE

N81-12580# Raytheon Service Co., Arlington, Va.
WIND ENERGY SYSTEMS: PROGRAM SUMMARY
May 1980 237 p refs
(Contract DE-AC01-78ET-20097)
(DOE/CS-20097/01) Avail: NTIS HC A11/MF A01

The Federal Wind Energy Program (FWEP) was initiated to provide focus, direction and funds for the development of wind power. Each of the Department of Energy's (DOE) current wind energy projects initiated or renewed during FY 1979 (October 1, 1978 through September 30, 1979) are summarized and their status as of April 30, 1980 is described. The summary highlights ongoing research, development and demonstration efforts and serves as a record of progress towards the program objectives. It also provides the program's general management structure; review of last year's achievements; forecast of expected future trends; documentation of the projects conducted during FY 1979; and list of key wind energy publications. DOE

N81-12581# Purdue Univ., Fort Wayne, Ind. Dept. of Chemistry.
SOLAR CELL UTILIZING PHOTOCHEMICAL GENERATION OF ELECTRICITY Final Research Report
Kenneth L. Stevenson 1979 15 p refs
(Grant DE-FG02-79R5-10114)
(DOE/R5-10114/1) Avail: NTIS HC A02/MF A01

The performance and parameter optimization of iodine photogalvanic cells were studied. The effects of solute and solvent, solvent concentration, electrode resistance and material, wavelength dependence, distance between electrodes, and temperature on cell performance were examined experimentally. Results are presented and discussed. DOE

N81-12582# American Association for Vocational Instructional Materials, Athens, Ga.
PROVIDING FOR ENERGY EFFICIENCY IN HOMES AND SMALL BUILDINGS. PART 1: UNDERSTANDING AND PRACTICING ENERGY CONSERVATION IN BUILDINGS
Jun. 1980 87 p refs
(Contracts DE-AC01-77IR-06065; EX-77-R-01-6065)
(DOE/IR-06065/1-Pt-1) Avail: NTIS HC A05/MF A01

A training program to educate students and individuals in the importance of conserving energy and to provide for developing skills needed in the application of energy saving techniques that result in energy efficient buildings is described. Topics included understanding the importance of energy, developing a concern for conserving energy, and understanding the use of energy in buildings. DOE

N81-12583# National Homes Corp., Lafayette, Ind.
PRELIMINARY DESIGNS: PASSIVE SOLAR MANUFACTURED HOUSING Technical Status Report
12 May 1980 52 p
(Contract DE-FC02-80CS-30377)
(DOE/CS-30377/1) Avail: NTIS HC A04/MF A01

The criteria established to guide the development of the preliminary designs are listed. Three preliminary designs incorporating direct gain and/or sunspace are presented. Costs, drawings, and supporting calculations are included. DOE

N81-12584# Fairbrother and Gunther, Inc., Grand Rapids, Mich.
SOLAR HOT WATER SPACE HEATING SYSTEM Technical Progress Report
Tom VanDam 13 Aug. 1979 233 p
(Contract DE-AC02-77CS-34412)
(DOE/CS-34412/18) Avail: NTIS HC A11/MF A01

A retrofit solar heating system was installed on Madison Hall at Jordan College, Cedar Springs, Michigan. The system provides heating and domestic water preheating for a campus dormitory. Freeze protection is provided by a draindown system. The building and solar system, construction progress, and design changes are described. Included in appendices are: condensate trape design, structural analysis, pictures of installation, operating instructions, maintenance instructions, and as built drawings. DOE

N81-12585# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Dec. 1979 - 19 Mar. 1980
Mark Ueland 19 Jun. 1980 7 p
(Contract DE-FG02-77CS-34135; Grant EG-77-G-04-4135)

(DOE/EG-34135/10; TPR-10) Avail: NTIS HC A02/MF A01

The atrium is designed to be constructed of materials and equipment that are economical and readily available. Cost effectiveness of installation and operation is a primary design objective. The solar atrium is a further development of efforts begun in the 1930's and 1940's to design houses that would obtain a major portion of their heating from the Sun. The early solar house experiments proved the benefits of large glazed areas for trapping solar energy. However, they were not equipped to collect and store surplus solar energy, nor were they equipped to control heat losses through glass areas at night or during cloudy days. The solar atrium incorporates the large glass areas of the earlier houses and adds facilities for heat storage and control of heat losses through glass. Progress and plans are outlined. DOE

N81-12586# Bickle/CM, Inc., Albuquerque, N. Mex.
PERFORMANCE DATA FOR PASSIVE SYSTEMS. THE NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY TEST ROOMS
Jun. 1980 34 p Prepared in cooperation with the National Center for Appropriate Technology, Butte, Mont.
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TR-0924-3) Avail: NTIS HC A03/MF A01

Direct gain and Trombe wall test cells were constructed to assess the performance of such systems and provide data for the validation of a computer model. The environmental, building, passive solar system, data acquisition system, and system thermal performance are described. DOE

N81-12587# California Univ., Livermore. Lawrence Livermore Lab.
OPEN-LOOP HELIOSTAT REFLECTOR
George T. Koide 30 Jul. 1980 30 p
(Contract W-7405-eng-48)
(UCID-18764) Avail: NTIS HC A03/MF A01

A microcomputer controlled heliostat driven in an elevation/azimuth gimbal arrangement with simple shaft encoders is discussed. The device can reflect a sunlight beam to within + or - two inches vertically and + or - one inch horizontally at a distance of seven feet from the target, which corresponds to an arc of + or - 1.5 deg. To minimize the error in tracking, the reflector should be aligned as accurately as possible with the north-south axis, with a transit or solar noon. DOE

N81-12588# Department of Energy, Washington, D. C. International Affairs Office of Current Reporting.
INTERNATIONAL ENERGY INDICATORS
Elizabeth K. Bauer, ed. Aug. 1980 30 p
(DOE/IA-0010/2) Avail: NTIS HC A03/MF A01

Data are compiled in tables and graphs on Iran and Saudi Arabia: crude oil capacity, production, and shut-in, June 1974 to July 1980; OPEC (Ex-Iran and Saudi Arabia): capacity, production, and shut-in, June 1974 to June 1980; non-OPEC Free World and US production of crude oil, January 1973 to May 1980; oil stocks: Free World, US, Japan, and Europe (landed), 1973 - 1st quarter 1980; petroleum consumption by industrial countries, January 1973 to February 1980; USSR crude oil production, January 1974 to July 1980; Free World and US nuclear generation capacity, January 1973 to June 1980; US import of crude oil and products, January 1973 to July 1980; landed cost of Saudi crude in current and 1974 dollars, April 1974 to May 1980; US trade in coal, January 1973 to June 1980; summary of US merchandise trade, 1976 to June 1980; and energy/GNP ratio, 1974-1st quarter 1980. The highlight of each is summarized in the table of contents. DOE

N81-12589# Exxon Research and Engineering Co., Linden, N.J.
DEVELOPMENT OF EVALUATION TECHNIQUES FOR ELECTROCHEMICAL ENERGY STORAGE SYSTEMS Final Report, 1 Oct. 1978 - 31 Mar. 1980
Lewis H. Gaines and Kenneth Nazimek 15 Mar. 1980 93 p
(Contract EM-78-C-01-5157)
(CONS-5157-T1) Avail: NTIS HC A05/MF A01

The development of standardized techniques for the comparative evaluation of electric vehicle battery technologies is summarized. The methodology considers both the traditional measures of battery performance (energy density, energy storage costs, and cycle life) and the equally important usage related battery characteristics (probability of technical success, operating and maintenance parameters, and safety/environmental impact). This comparative rationale is supplemented by the ability to generate battery test programs normalized to specific technologies and electric vehicle mission specifications. These test programs allow the evaluation of different battery technologies at comparable levels of electric vehicle performance. It was found that cost optimized electric passenger vehicles will have range specifications of 100 to 110 KM, depending on the specific performance of the battery. Longer range vehicles are penalized by higher first costs while shorter range vehicles suffer from reduced battery life and the need for more frequent alternative car rentals (presumably petroleum fueled) for trips which exceed the EV's range capability. DOE

N81-12590# Department of Energy, Washington, D. C. Office of Energy Research.
DOD-DOE WORKSHOP ON JOINT ENERGY ACTIVITIES
1980 113 p refs Workshop held at Gaithersburg, Md., 10-12 Mar. 1980
(CONF-800383) Avail: NTIS HC A06/MF A01

The general conditions for DOD-DOE interactions were delineated in an October 1978, Memorandum of Understanding (MOU) that identified two basic goals: improving energy efficiency and availability within DOD, and utilizing DOD and DOE expertise and facilities to carry out projects of mutual interest. A DOD-DOE Workshop on Joint Energy Activities was held on March 10 to 12, 1980. The workshop was structured into five working groups (mobility fuels, conservation, fossil fuels for fixed facilities, solar and renewable energy sources, and special projects) with DOD and DOE cochairmen for each. The workshop accomplished its goals, these being to: (1) improve communication among the appropriate key DOD and DOE personnel at all levels and promote information exchange; (2) review ongoing and already proposed joint DOD and DOE programs; (3) initiate a coordinated, systematic effort to establish joint DOD-DOE energy security programs; and (4) propose specific programs and projects of mutual interest for inclusion in a follow-on joint implementation plan. DOE

N81-12591# New Mexico Univ., Albuquerque. Dept. of Chemistry.
EFFECTS OF SEVERAL TRACE CONTAMINANTS ON FUEL CELL PERFORMANCE
S. M. Parks and T. J. OBrien (DOE, Morgantown, W. Va.) 1979 27 p refs
(DOE/METC-RI-80-17) Avail: NTIS HC A03/MF A01

The electrochemical reactivity of various trace contaminants in coal gas, i.e., Hg/HgS, PbS, CdS, Sn/SnCl2/SnCl4, and TiO2, in coal gas at the nickel anode and the nickel oxide cathode in a molten carbonate fuel cell are examined thermodynamically. Calculations indicate that only SnCl4 undergoes reduction at the cathode to SnCl2. Other species remain intact. Contaminants such as H2S/SO2 and HCl are included in the calculation. Possible chemical interactions between contaminants and electrodes or electrolytes have been examined. Mercury interacts physically with the anode by forming an alloy. Reactions of Sn, SnCl2, and HCl with the nickel oxide cathode have negative free energies. DOE

N81-12592# Argonne National Lab., Ill. Energy and Environmental Systems Div.
LASER SATELLITE POWER SYSTEMS
E. W. Walbridge Jan. 1980 84 p refs
(Contract W-31-109-eng-38)
(ANL/ES-92) Avail: NTIS HC A05/MF A01

A laser satellite power system (SPS) converts solar power captured by Earth-orbiting satellites into electrical power on the Earth's surface, the satellite-to-ground transmission of power being effected by laser beam. The system has four important advantages over a microwave system: land requirements are much less, radiation levels are low outside the laser ground stations, laser beam sidelobes are not expected to interfere with electromagnetic systems, and the laser system lends itself to small-scale demonstration. After describing lasers and how they work, the five lasers that are candidates for application in a laser SPS: electric discharge lasers, direct and indirect solar pumped lasers,

free electron lasers, and closed-cycle chemical lasers are discussed. DOE

N81-12593# General Electric Co., Washington, D. C. Power Systems Strategic Planning and Development Operation.
ENERGY USE IN OFFICE BUILDINGS. VOLUME 1: ANALYSIS OF 1977 OFFICE BUILDING ENERGY USE AS REPORTED IN THE BUILDING OWNERS AND MANAGERS ASSOCIATION DATA BASE
29 Aug. 1980 136 p refs
(DOE/CS-20189/1) Avail: NTIS HC A07/MF A01

The results of task IA of the Energy Use in Office Buildings Project: an analysis in tabular form of the 1977 office building energy use data base of the Building Owners and Managers Association (BOMA) are presented. BOMA's approximately 4000 members directly manage over 500 million sq ft of commercial office space which is approximately 16% of total commercial office building space. Energy use data were reported by BOMA in terms of kWh of electricity, cu ft of gas, gal of oil, and lb of steam. The data were converted to BTu's, and all building energy measures were expressed in terms of Btu per sq ft. Analysis for commercial office buildings and government office buildings is presented. DOE

N81-12594# Brookhaven National Lab., Upton, N. Y. Applied Mathematics Dept.
EXPERIMENT IN MULTIPLE-CRITERIA ENERGY POLICY ANALYSIS
James K. Ho Jul. 1980 18 p refs Presented at Intern. Conf. on Multiple Criteria Decision Making, Newark, Del., 11 Aug. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28154; CONF-800847-1) Avail: NTIS HC A02/MF A01

An international panel of energy analysts participated in an experiment to use HOPE (holistic preference evaluation): an interactive parametric linear programming method for multiple criteria optimization. The criteria of cost, environmental effect, crude oil, and nuclear fuel were considered, according to BESOM: an energy model for the US in the year 2000. DOE

N81-12595# Brookhaven National Lab., Upton, N. Y.
APPROACH TO PERFORMANCE EVALUATION OF A DOUBLE WALL CONVECTIVE LOOP HOUSE
Homayoun T. Ghaffari, Ralph F. Jones, and Gerald Dennehy 1980 7 p refs Presented at 5th Natl. Passive Solar Energy Conf., Amherst, Mass., 19-26 Oct. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28192; CONF-801016-14) Avail: NTIS HC A02/MF A01

A double wall house of Ekose'a design, located in Middletown, RI, was evaluated. The technical approach employed in monitoring and analyzing the thermal performance of the building is described. DOE

N81-12596# American National Standards Inst., New York.
SOLAR STANDARDS COORDINATED BY THE STEERING COMMITTEE ON SOLAR ENERGY STANDARDS DEVELOPMENT CONTENTS Status Report
18 Aug. 1980 33 p
(Contract DE-AC01-79CS-30118)
(DOE/CS-30118/T3; SCSE-SR-3) Avail: NTIS HC A03/MF A01

Solar standards are listed for each of the standards writing organizations associated with the Steering Committee. A complete list of approved standards under development, and standards under revision is provided. DOE

N81-12597# Pennsylvania State Univ., University Park.
CONTROLLED CADMIUM TELLURIDE THIN FILMS FOR SOLAR CELL APPLICATIONS, EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS Final Technical Report, 9 Apr. 1979 - 8 Apr. 1980
K. Vedam, M. B. Das, and S. V. Krishnaswamy Jun. 1980 41 p refs
(Contract DE-AC02-79ET-23013)
(DOE/ET-23013/T5) Avail: NTIS HC A03/MF A01

CdTe sputtered self doped and indium doped n-type layers on Ni film on glass was investigated for film resistivity, contact resistance, Hall mobility and Schottky barrier diode characteristics. Ni was found to provide satisfactory ohmic contacts and self doped samples have indicated Hall mobility of approximately 8 sq cm per Vsec when the effective doping concentration is approximately 10 to the 18th power per cu cm. Use of indium doped sputtered films, when properly surface treated prior to metallization appear to yield the best kind of Schottky barrier diode. Suggestions for future work are presented. DOE

N81-12598# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR REPOWERING FOR ELECTRIC GENERATION. NORTHEASTERN STATION UNIT 1, PUBLIC SERVICE COMPANY OF OKLAHOMA
15 Jul. 1980 251 p Prepared in cooperation with the Public Service Co. of Oklahoma and Babcock and Wilcox Co., Lynchburg, Va.
(Contract DE-AC03-79SF-10738)
(DOE/SF-10738/1-3) Avail: NTIS HC A12/MF A01

This plant was selected because it is representative of candidate plants for repowering and for solar fossil hybrid operation; it is located in a moderate insolation region, utilizes an efficient reheat cycle with steam conditions characteristic of modern power plants, and has sufficient land for repowering. NES-1 has a subcritical, single reheat turbine generator and a gas fired steam generator. The basic repowering configuration was established through a series of trade studies and the criterion that proven technology be used. The system selected has a water/steam receiver which supplies superheated steam to the turbine at a design point flow rate sufficient to displace 20 percent of the unit's fossil fuel consumption. DOE

N81-12599# Oregon State Univ., Corvallis. Dept. of Civil Engineering.
WAVE POWER EXTRACTION FROM A TRANSIENT HEAVING CYLINDER
Robert T. Hudspeth and Larry S. Slotta Jan. 1980 18 p refs
(Contract DE-AP01-79ET-21019)
(DOE/ET-21019/T1) Avail: NTIS HC A02/MF A01

Waver power extracted from the transient motion of a periodically restrained released heaving circular cylinder proposed by Falnes and Budal is examined under the limitations of linear wave theory excitation. Numerical estimates for the normalized radiated wave amplitudes required for the waveforce excitation derived by Mei are computed from the computationally efficient variational method developed by Black and Mei for the wave force diffraction regime. Wave power estimates for the rising period only of the heaving motion are given; while the falling period of the motion is neglected. A graphical summary is presented which demonstrates the parametric dependency of the dimensionless wave power rate on the design wave parameters and the body geometry for three general types of transient power systems heaving in deep water conditions. The total power requirements for the complete power extraction system as well as the real fluid viscous effects are not included. DOE

N81-12600# Black and Veatch Consulting Engineers, Kansas City, Mo.
SOLAR REPOWERING FOR ELECTRIC GENERATION. NORTHEASTERN STATION UNIT 1, PUBLIC SERVICE COMPANY OF OKLAHOMA Final Report
1980 292 p Prepared in cooperation with the Public Service Co. of Oklahoma, Tulsa and Babcock and Wilcox Co., Lynchburg, Va.
(Contract DE-AC03-79SF-10738)
(DOE/SF-10738-1/2) Avail: NTIS HC A13/MF A01

The conceptual design and evaluation of solar repowering and electric generating unit of Public Service Company of Oklahoma (PSC) are described in detail. The solar addition would permit, at the design point, a 20% reduction of the fossil fuel consumed by PSO's 150 MWe Northeastern Station Unit 1. The proposed system comprises a tower focus power plant with a water/steam central receiver. The trade studies, conceptual design, system performance, economic analysis, and development plan as well as a description of a test program to determine the magnitude of impact that environmental factors have on plant design and performance are presented. DOE

N81-12601# RCA Labs., Princeton, N. J.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SILICON SOLAR CELLS Quarterly Report, 1 Feb. - 30 Apr. 1980
David Redfield May 1980 21 p refs
(Contract DE-AC01-79ET-23108)
(DOE/ET-23108/4: QR-3) Avail: NTIS HC A02/MF A01

In the area of heavy doping effects there are two significant recent developments. One concerns J0 the saturation current density of shallow p-n junctions in which essentially all minority carriers generated are collected by the junction (e.g., solar cells with good blue response). It is shown that for such cases J0 is proportional to the junction depth. The second result concerns the role of Auger recombination in n-type bases of solar cells. It is shown that, as in p-type bases, the reduction in I/sub sc/ caused by heavy doping is explained by Auger recombination that becomes apparent at densities of 10 to the 18th power per cubic cm Increased work in the modeling of electrical properties of grain boundaries appears to have opened a new path to understanding a number of observations of these properties. On the basis of several types of measurements and the reports of others in the field, it is shown that a quasi surface model for the electrical properties describes the boundaries much better than does the crystallographic nisorientation model. DOE

N81-12602# Motorola, Inc., Phoenix, Ariz. Semiconductor Group.
SEQUENTIAL PURIFICATION AND CRYSTAL GROWTH FOR THE PRODUCTION OF LOW COST SILICON SUBSTRATES Quarterly Technical Progress Report, 1 Apr. - 30 Jun. 1980
Ming Liaw and Frank Secco DAragona Aug. 1980 32 p refs
(Contract DE-AC02-77CH-00178)
(DOE/SERI/8229-3/2-T6; QTPR-3) Avail: NTIS HC A03/MF A01

Low cost processing for fabricating large grain size polycrystalline silicon substrates is discussed. Metallurgical grade silicon (MG-Si) is chosen as the starting material for sequential purification and crystal growth. Several purification techniques are studied. They include acid leaching with HCl, physical separation of insoluble impurities, reactive gas treatment of molten silicon, and slagging using a mixed oxide slag. Purification by vacuum treatment and by impurity redistribution using ingot pulling is studied. DOE

N81-12603# Poly Solar, Inc., Garland, Tex.
LOW COST THIN FILM POLYCRYSTALLINE SILICON SOLAR CELLS Final Report, 15 Mar. 1979 - 31 Jul. 1980
Jul. 1980 48 p refs
(Contract DE-AC03-79ET-23048)
(DOE/ET-23048/T1) Avail: NTIS HC A03/MF A01

The objective was to advance the thin film silicon solar cell technology with a view toward achieving photovoltaic conversion efficiencies greater than 10% at a cost of $100 to $300/kWe. The purification of metallurgical silicon by acid extraction and phosphorus oxide treatment was studied in detail. The minimum iron concentration obtainable was about 500 ppMa by the acid extraction technique and was about 200 ppMa by the gettering technique. A standard procedure was developed for the acid extraction of metallurgical silicon, however, considerable difficulties were encountered in the large scale gettering process. Metallurgical silicon substrates were prepared from the unidirectional solidification of the melt on graphite by the stationary and moving coil techniques. Many large area solar cells were prepared from acid extracted metallurgical silicon substrates by depositing the active region using the trichlorosilane process. The best cells have AM1 efficiencies of about 7.7%, and their photovoltaic properties were characterized. DOE

N81-12604# Coury and Associates, Inc., Lakewood, Colo.
RESIDENTIAL AND COMMERCIAL SPACE HEATING AND COOLING WITH POSSIBLE GREENHOUSE OPERATION: BACA GRANDE DEVELOPMENT, SAN LUIS VALLEY, COLORADO Final Report
Steven W. Goering, Kenneth L. Garing, Glenn E. Coury, and Eugene A. Fritzler May 1980 288 p refs
(Contract DE-AC07-78ET-28455)
(DOE/ET-28455/3) Avail: NTIS HC A13/MF A01

A feasibility study was performed to evaluate the potential of multipurpose applications of moderate temperature geothermal waters in the vicinity of the Baca Grande community development in the San Luis Valley, Colorado. Engineering designs were developed for geothermal district heating systems for space heating and domestic hot water heating for residences, including a mobile home park, an existing motel, a greenhouse complex, and other small commercial uses such as aquaculture. In addition, a thorough institutional analysis of the study area was performed to highlight factors which might pose barriers to the ultimate commercial development of the resource. Finally, an environmental evaluation of the possible impacts of the proposed action was also performed. The institutional and environmental analyses indicate that no significant barriers to development are apparent. DOE

N81-12605# ROM-AIRE Solar Corp., Avon Lake, Ohio.
LOW COST, BARE PLATE SOLAR AIR COLLECTOR Semiannual Progress Report
1980 15 p ref
(Contract DE-FG02-79RE-10143)
(DOE/R5-10143/1) Avail: NTIS HC A02/MF A01

A low cost, bare plate solar collector designed to preheat ambient air with solar energy is discussed. Two prototype solar collector test systems were designed, fabricated and assembled. Each system was instrumented to provide instantaneous and average thermal performance data by means of a computerized data logger system. Preliminary test data were obtained for both prototype systems. Ambient air was preheated between 3 F and 10 F with the systems achieving a thermal performance of between 15 percent and 30 percent efficiency. DOE

N81-12606# Ames Design Collaborative, Iowa.
EXPERIMENTAL AND THEORETICAL STUDY OF THERMAL PERFORMANCE OF A HYBRID SOLAR SYSTEM AT LIVING HISTORY FARMS Final Report, 19 Sep. 1977 - 31 Aug. 1980
John R. Hull 1980 28 p refs
(Contract DE-FG04-77CS-34136)
(DOE/CS-34136/1) Avail: NTIS HC A03/MF A01

The development and study of the salt gradient solar pond and hybrid solar house at the Farm of Today and Tomorrow at Living Histor Farms are described. The backgroun of the project is given and includes conceptualization to present status. The construction history is summarized. The instrumentation and experimental results from the solar pond are discussed, as well as conclusions in regard to solar pond operation and gradient zone stability. The solar pond operated for over a year and supplied interesting experimental observations about stability of the salt gradient. DOE

N81-12607# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
INTERDIGITATED BACK CONTACT SOLAR CELLS Annual Report
M. S. Lundstrom and R. J. Schwartz Aug. 1980 144 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7104) Avail: NTIS HC A07/MF A01

The interdigitated back contact solar cell (IBC cell) was shown to possess a number of advantages for silicon solar cells, which operate at high concentration. A detailed discussion of the factors which need to be considered in the analysis of semiconducting devices which utilize heavily doped regions such as those which are found in solar cells in both the emitter and in the back surface field regions is given. This discussion covers the questions of: how to handle degeneracy, how to compute carrier concentrations in the absence of knowledge of the details of the band structure under heavily doped conditions, and how to reconcile the usual interpretation of heavy doping as a rigid shift of the bands with the band tailing and impurity level conduction models. It also discusses the reasons for the observed discrepancies between various experimental measurements of bandgap narrowing. DOE

N81-12608# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SOLAR TOTAL ENERGY MODULARITY STUDY Final Report

Aug. 1980 203 p refs Prepared for Sandia Labs., Albuquerque, N. Mex.
(Contract DE-AC04-76DP-00789)
(SAND-80-7060) Avail: NTIS HC A10/MF A01

The results of a 26 month study which included the survey of industrial sites to obtain site specific energy demand data and other information pertinent to designing solar total energy systems for the sites are presented. Solar systems, using single axis tracking parabolic trough solar collectors were designed for each of the sites to the depth necessary to verify feasibility and identify major system components. Cost and performance estimates for each of the systems were estimated and used to predict internal rate of return over a range of collector cost and performance. Parametric system and component performance data are presented along with solar insolation data for all the Sol-Met data stations which allows the rapid assessment of solar system feasibility for future potential industrial users. DOE

N81-12609# Battelle Pacific Northwest Labs., Richland, Wash.
HELIOSTAT MIRROR SURVEY AND ANALYSIS
M. A. Lind, C. Q. Buckwalter, J. L. Daniel, J. S. Hartman, M. T. Thomas, and L. R. Pederson Sep. 1979 185 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3194) Avail: NTIS HC A09/MF A01

Field experience in existing systems showed that the performance of the reflective surface varies greatly with time and is influenced to a large extent by the construction details of the mirror module. Degradation of the reflective layer was seen that ranged from nonobservable to severe. The exact mechanisms involved in the degradation process are not well understood from either the phenomenological or microanalytical points of view and are thus subject to much debate. The work recently performed in three general areas that are key to understanding and ultimately controlling the degradation phenomena is summarized. These areas are: a survey of the present commercial mirroring industry, the microanalytical examination of numerous degraded and nondegraded mirrors, and an investigation of several novel techniques that might be used to extend the life of heliostat mirrors. DOE

N81-12610# Applied Solar Energy Corp., City of Industry, Calif.
AUTOMATED LINEAR CONCENTRATOR CELL MODULE ASSEMBLY
S. Khemthong, K. S. Ling, S. Olah, and W. J. Sampson Aug. 1980 37 p
(Contract DE-AC04-76DP-00789)
(SAND-80-7103) Avail: NTIS HC A03/MF A01

The objectives of this program were to reduce the cost of linear photovoltaic concentrator cell modules by reducing the cost of interconnection, encapsulation, and module assembly; to design and fabricate equipment for semi-automation; and to fabricate and deliver five (5) prototype modules of approximately four (4) feet in length utilizing semi-automated equipment. All of these objectives were accomplished. The procedure and equipment are described. DOE

N81-12611# Franklin Pierce Law Center, Concord, N. H.
SUMMARY OF THE MIDWEST CONFERENCE ON SMALL-SCALE HYDROPOWER IN THE MIDWEST: AN OLD TECHNOLOGY WHOSE TIME HAS COME
May 1980 147 p Conf. held in Detroit, 14-16 Nov. 1979
(Contract DE-AS02-78RA-04934)
(DOE/RA-04934/05; CONF-791199-Summ) Avail: NTIS HC A07/MF A01

Legal and institutional obstacles to small scale hydroelectric development in Illinois, Indiana, Kentucky, Michigan, Ohio, West Virginia, and Wisconsin were examined in during four workshop sessions. Prospects and efforts to reform federal, state, and local regulatory systems are discussed as well as the economics of small scale hydroelectric development and relationships with electric systems. The usefulness of a computer model of system dynamics was also considered. A.R.H.

N81-12612# Brookhaven National Lab., Upton, N. Y. Economic Analysis Div.
A STRATEGIC COST-BENEFIT ANALYSIS OF ENERGY POLICIES: OVERVIEW
Harry Davitian, Richard J. Goettle, IV (Jorgenson (Dale W.) Associates), Paul J. Groncki, Edward A. Hudson (Jorgenson (Dale W.) Associates), Peter Kleeman, and Joan Lukachinski Oct. 1979 24 p refs
(Contract DE-AC02-76CH-00016)
(BNL-51105) Avail: NTIS HC A02/MF A01

Three possible energy strategies are described and each is analyzed in terms of its economic, environmental, and national security benefits and costs. Each strategy is represented by a specific policy. The results indicate that conservation can substantially reduce import dependence and slow the growth of energy demand, with only a small macroeconomic cost and with substantial benefits; the synfuels policy reduces inports by a smaller amount, does not reduce the growth in energy demand, involves substantial environmental costs and slows the rate of economic growth. These relationships could be different if the energy savings per unit cost for conservation are less than anticipated, or if the costs of synthetic fuels can be significantly lowered. A brief discussion of the motivation for the study, the assumptions and methodologies employed, the results, and the policy implication are presented. E.D.K.

N81-12613# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.
A STRATEGIC COST-BENEFIT ANALYSIS OF ENERGY POLICIES: DETAILED PROJECTIONS
Harry Davitian, Richard J. Goettle, IV, Paul J. Groncki, Edward A. Hudson, Peter Kleeman, and Joan Lukachinski Oct. 1979 75 p refs Sponsored by DOE
(BNL-51127) Avail: NTIS HC A04/MF A01

Three possible energy strategies are described and each is analyzed in terms of its economic, environmental, and national security benefits and costs. Each strategy is represented by a specific policy. In the first strategy no additional programs or policies are initiated beyond those currently in effect or announced. The second is directed toward reducing the growth in energy demand, i.e., energy conservation. The third promotes increased domestic supply through accelerated development of synthetic and unconventional fuels. The analysis focuses on the evaluation and comparison of these strategy alternatives with respect to their energy, economic, and environmental consequences. The results indicate that conservation can substantially reduce import dependence and slow the growth of energy demand, with only a small macroeconomic cost and with substantial environmental benefits; the synfuels policy reduces imports by a smaller amount, does not reduce the growth in energy demand, involves substantial environmental costs and slows the rate of economic growth. Author

N81-12614# Argonne National Lab., Ill.
HIGH-PERFORMANCE BATTERIES FOR ELECTRIC-VEHICLE PROPULSION AND STATIONARY ENERGY STORAGE Progress Report, Oct. 1978 - Sep. 1979
Mar. 1980 258 p refs
(Contract W-7405-eng-38)
(ANL-79-94) Avail: NTIS HC A12/MF A01

A 40 kW-hr electric vehicle battery (designated Mark 1A) was fabricated and delivered for testing. During the initial heat up, one of the two modules failed due to a short circuit. A failure analysis was conducted and the Mark 1A program completed. Development work on the next electric vehicle battery (Mark 2) was initiated. Work on stationary energy storage batteries during this period has consisted primarily of conceptual design studies. E.D.K.

N81-12615# Argonne National Lab., Ill. Analytical Chemistry Lab.
METHODS OF CHEMICAL ANALYSIS USED TO CHARACTERIZE BATTERY MATERIALS
Kenneth J. Jensen and W. Elane Streets May 1980 51 p refs
(ANL-80-41) Avail: NTIS HC A04/MF A01

Procedures are given for the chemical analysis of a variety of materials of interest in battery development and research. These materials include LiCl-KCl eutectic, Li-Al alloys, lithium sulfide, lithium aluminum chloride, calcium sulfide, titanium sulfide and various sulfides of iron, nickel, copper, and cobalt. Author

N81-12616# Hughes Research Labs., Malibu, Calif.
INDIUM PHOSPHIDE/CADMIUM SULFIDE THIN-FILM SOLAR CELLS Quarterly Technical Progress Report, Dec. 1979 - Apr. 1980
K. Zanio Jun. 1980 23 p refs
(Contract De-AC02-77CH-00178)
(SERI/PR-8170-1-T1; QTPR-3) Avail: NTIS HC A02/MF A01

Thin films and large grains of InP were epitaxially deposited on low cost recrystallized CdS (RXCdS) substrates at 280 C by planar reactive deposition. At 380 C, a 0.4 to 1.0 micrometer thick In-Cd-S transition layer between the InP and the RXCdS degrades the quality of the InP epitaxy. However, p-type InP films were prepared at this temperature by Be-doping and capping the entire RXCdS substrate with InP. Large grains of CdTe were also deposited on RXCdS substrates at 460 C by physical vapor deposition. The grain size of the RXCdS is typically 40 micrometer. However, during this period we prepared RXCdS with grains having dimensions up to 300 micrometer. DOE

N81-12617# Argonne National Lab., Ill. Materials Science Div.
DEVELOPMENT OF NONDESTRUCTIVE EVALUATION TECHNIQUES FOR HIGH-TEMPERATURE CERAMIC HEAT EXCHANGER COMPONENTS Quarterly Report, Apr. - Jun. 1980
Aug. 1980 35 p refs
(Contract W-31-109-eng-38)
(ANL/MSD/FE-80-4; QR-11) Avail: NTIS HC A03/MF A01

Problems associated with mode conversion of ultrasonic waves during longitudinal wave testing of silicon carbide tubes with an ultrasonic boreside probe are discussed. The problem is significantly reduced by making the rotating mirror to limit the ultrasonic beam width. Infrared scanning techniques were used to evaluate silicon carbide tube overlap joints. Preliminary results suggest that anomalies not detectable by radiography and ultrasonic methods can be visualized with infrared techniques. Holographic interferometry techniques employing a television camera and videotape system for visualizing interference fringes were used successfully with silicon carbide butt-joined tubes to reveal discontinuities at a joint. E.D.K.

N81-12618# Little (Arthur D.), Inc., Cambridge, Mass.
AN EVALUATION OF SUPERCONDUCTING MAGNETIC ENERGY STORAGE
Nov. 1979 97 p
(Contract W-31-109-eng-38)
(ANL-K-79-4917-1) Avail: NTIS HC A05/MF A01

Superconducting magnetic energy storage (SMES) systems were analyzed as to their possible benefits to the electric utility industry. The SMES systems will be able to store and delivery energy at very high efficiency while being able to switch from the charge to discharge mode in a few tens of milliseconds. An economic analysis for the SMES system is presented. T.M.

N81-12619# Argonne National Lab., Ill. Environmental Impact Studies Div.
ECOLOGICAL AND BIOMEDICAL EFFECTS OF EFFLUENTS FROM NEAR-TERM ELECTRIC VEHICLE STORAGE BATTERY CYCLES
May 1980 333 p refs
(Contract W-31-109-eng-38)
(ANL/ES-90) Avail: NTIS HC A15/MF A01

The lead/acid battery cycle from mining and milling of raw materials through recycling of scrap batteries and disposal of wastes is described. Material flows and emissions for various phases of the total cycle are estimated for per megawatt hour of installed capacity and for a scenario of three million lead/acid electric vehicles on the road by the year 2000. Author

N81-12620# Midwest Research Inst., Kansas City, Mo.
ASSESSMENT OF ENERGY AND ECONOMIC IMPACTS OF PARTICULATE CONTROL TECHNOLOGIES IN COAL-FIRED POWER GENERATION
V. Ramanathan, S. Reigel, P. Gorman, Paul S. Farber, M. Tisue, and Floyd C. Bennett Apr. 1980 249 p refs Prepared in cooperation with Argonne National Lab., Ill.
(Contract W-31-109-eng-38)
(ANL/ECT-9) Avail: NTIS HC A11/MF A01

Models were derived which to assess the economic and energy impacts of particulate control systems for coal fired power plants. The models take into account the major functional variables, including plant size and location, coal type, and applicable particulate emission standards. The algorithms obtained predict equipment and installation costs, as well as operating costs (including energy usage), for five control devices: (1) cold side electrostatic precipitators; (2) hot side electrostatic precipitators; (3) reverse flow baghouse; (4) shake baghouses; and (5) wet scrubbers. A stream generator performance model was developed, and the output from this model was used as input for the control device performance models that specify required design and operating parameters for the control systems under study. These parameters were used as inputs to the cost models. E.D.K.

N81-12621# Argonne National Lab., Ill. Energy and Environmental Systems Div.
RELIABILITY, ENERGY, AND COST EFFECTS OF WIND POWERED GENERATION INTEGRATED WITH A CONVENTIONAL GENERATING SYSTEM
J. C. VanKuiken, W. A. Buehring, C. C. Huber, and K. A. Hub Jan. 1980 114 p refs
(Contract W-31-107-eng-38)
(ANL/AA-17) Avail: NTIS HC A06/MF A01

The potential impacts of incorporating wind turbines, without the aid of energy storage devices, into a conventional electrical generating system were examined. Particular emphasis was given to the amount and type of generating capacity replaced by wind (potential variable cost savings), and the methods used to calculate these benefits. A cost model was developed to estimate breakeven costs for wind turbines on the basis of energy and capacity displacement savings. R.C.T.

N81-12622# Argonne National Lab., Ill.
ARGONNE SOLAR ENERGY PROGRAM. SUMMARY OF SOLAR PROGRAM ACTIVITIES Annual Report, fiscal year 1979
Jun. 1980 83 p refs
(Contract W-31-109-eng-38)
(ANL-80-80) Avail: NTIS HC A05/MF A01

Various applications of solar energy were examined. Particular emphasis was given to: solar energy collection; heating and cooling; thermal energy storage; ocean thermal energy conversion; photovoltaics; biomass conversion; satellite power systems; and solar liquid metal magnetohydrodynamic power systems. R.C.T.

N81-12623# Sandia Labs., Albuquerque, N. Mex.
BLACK CHROME SOLAR SELECTIVE COATING
R. B. Pettit and R. R. Sowell 1980 13 p refs Presented at Line-Focus Solar Thermal Energy Technol. Development Conf., Albuquerque, N. Mex., 9 Sep. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1480C; CONF-800955-2) Avail: NTIS HC A02/MF A01

Electrodeposited black chrome solar selective coatings frequently experienced thermal stability problems when heated to temperatures above 250 C (480 F) in air. By reducing the trivalent chromium concentration in the standard black chrome plating bath, coatings on nickel substrates are obtained which are stable for thousands of hours at 350 C (660 F) and for hundreds of hours at 400 C (750 F). These results were obtained consistently on a laboratory scale, but difficulty in reproducing the results was encountered in a production environment. A current study of the effects of known plating variables in the optical properties and thermal stability of coatings is aimed at establishing an acceptable range for each plating parameter. A preliminary process specification for electroplating mild steel substrates with a stable black chrome coating is presented. DOE

N81-12624# Los Alamos Scientific Lab., N. Mex.
PASSIVE SOLAR DESIGN CALCULATIONS WITH THE DOE-2 COMPUTER PROGRAM
J. F. Kerrisk, J. E. Moore, N. M. Schnurr, and B. D. Hunn 1980 6 p refs Presented at the 5th Natl. Passive Solar Conf., Amherst, Mass., 19-26 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2340; CONF-801016-6) Avail: NTIS

HC A02/MF A01

The DOE-2 computer program was modified to improve modeling of passive solar buildings by the addition of the custom weighting factor method. The thermal load and air temperature calculation procedure in DOE-2 are described. Assumption inherent in the use of American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) precalculated and the custom weighting factors are discussed. Calculated results from DOE-2 are compared with measured heat extraction rates and air temperatures for four buildings. These comparisons indicate that DOE-2 can accurately model direct gain passive buildings and can treat night ventilative cooling and water walls in an approximate manner. DOE

N81-12625# Los Alamos Scientific Lab., N. Mex.
QUANTITATIVE COMPARISON OF PASSIVE SOLAR SIMULATION CODES
William O. Wray 1980 6 p ref Presented at the 5th Natl. Passive Solar Conf., Amherst, Mass., 19-26 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2267; CONF-801016-8) Avail: NTIS HC A02/MF A01

Several members of the Systems Simulation and Economic software comparison of passive solar simulation codes. The problems selected and defined by the Los Alamos Scientific Laboratory for analysis include both a vented and an unvented Trombe wall and a direct gain building. The individuals organizations, and associated computer models involved in this exercise are Byron Wynn, Colorado State University (CSU) (FREHEAT); Larry Palmitier, National Center for Appropriate Technology (NCAT) (SUNCAT); Bill Beckman, the University of Wisconsin (WIS) (TRNSYS); Bill Wray, LASL (PASOLE, SUNSPOT); and John Moore, LASL (DOE-2). Each of these organizations submitted simulation results and a comparative analysis was conducted. Excellent agreement was achieved on annual auxiliary heat loads, but several detailed heat fluxes within the structures showed significant scatter, as did both the ventilation and auxiliary cooling. DOE

N81-12626# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
STATIC AND DYNAMIC INVESTIGATIONS USING A WINDMILL MODEL [STATISCHE UND DYNAMISCHE UNTERSUCHUNGEN AN EINEM WINDROTORMODELL]
J. H. Argyris, K. A. Braun, B. Kirchgaessner, and R. Walther Jun. 1979 69 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4086A)
(ISD-259; ISSN-0170-6071) Avail: NTIS HC A04/MF A01

In the framework of wind energy research a scale model of a wind rotor was constructed, then used to develop and test a data acquisition and data transmission system. With this system experimental data are collected from the operating model and displayed on a screen. Comparison between experimental data and computed results for the model were used to check applied static and dynamic analyses of the rotor model. During the dynamic analysis a response problem with variable stiffness in time was found for this case a solution method involving systems of equations is described. Author (ESA)

N81-12627# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
LOAD CYCLE VALUES AND MATERIALS DATA USED FOR THE DESCRIPTION OF A WIND TURBINE FEATURING A SPECIAL HUB CONSTRUCTION [LASTWECHSELZAHLEN UND MATERIALWERTE FUER DIE AUSLEGUNG EINER WINDTURBINE SPEZIELLER NABENKONSTRUKTION]
J. H. Argyris and K. A. Braun Jun. 1979 38 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4086-A)
(ISD-260; ISSN-0170-6071) Avail: NTIS HC A03/MF A01

For the layout of windmill rotor blades made from different materials, analyses of materials data and geometry were made. Of special interest are the admissible stresses which are dependent on the material as well as kind and number of loading cycles. The number of these loading cycles thought to be relevant are determined. The decisive parameters are the number of starts and the time of operation. The dependence of these parameters on the cut-in wind velocity, the vertical wind gradient, and the wind characteristics is discussed. Wind data collected in northern Germany were used in calculating admissible stresses. The fagigue strengths are also estimated in terms of the admissible stresses determined. The materials used are well known glass fiber and carbon filber reinforced plastics. Author (ESA)

N81-12628# Stuttgart Univ. (West Germany). Inst. fuer Statik und Dynamik der Luft- und Raumfahrtkonstruktionen.
STATIC AND DYNAMIC INVESTIGATIONS ON DIFFERENT TOWERS FOR WIND TURBINES [STATISCHE UND DYNAMISCHE UNTERSUCHUNG VERSCHIEDENER TUERME FUER WINDTURBINEN]
J. H. Argyris and K. A. Braun Jul. 1979 122 p refs In GERMAN; ENGLISH summary
(Contract BMFT-ET-4086A)
(ISD-261; ISSN-0170-6071) Avail: NTIS HC A06/MF A01

The static layouts of different tower designs are studied in terms of gust loads which a two bladed rotor (120 m diameter) transfers to a rigid support as external loads. The rotor blades are assumed to be inelastic. Each one has a flapping hinge and a flap pitch coupling. First a cylindrical cantilever steel tower is dimensioned such that the maximal loads enlarged by a dynamic magnification factor provoke tolerable stresses and displacements. Next, both a cantilver and guyed tower static layout are considered and a dynamic response calculation for several gusts is performed using finite element methods. The tower system and the rotor system are assumed to be dynamically decoupled. The guyed tower proves to be superior. Finally, a theoretical type of tower is statically conceived using a geometrically nonlinear finite element program. The kinematics of three towers with different guy arrays are investigated and compared. Author (ESA)

N81-12629# Friedrichsfeld G.m.b.H., Mannheim (West Germany). Steinzeug- und Kunststoffwerke.
PRODUCTION TECHNOLOGY OF BETA-ALUMINA CERAMICS FOR Na/S BATTERIES Final Report, May 1978
Guenther Heimke and Gerd Willmann Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 117 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-T-79-57; ISSN-0340-7608) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 24,15

Fabrication processes to produce tubes of beta-alumina ceramics for use in Na/S batteries were defined. The selection of raw materials, the handling of the beta-alumina powders, and development of a shaping technique were considered. Parameters for spray drying could not be clarified. Test results on firing in a tunnel kiln with high heating/cooling rates show that the beta-alumina tubes can be produced economically with sufficient density, microstructure, and chemical composition in a way that is transferable to real production. Nevertheless, there is the problem of reducing fuel consumption in the kiln.
Author (ESA)

N81-12630# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
HIGH EFFICIENCY GaAs-GaAlAs SOLAR CELLS FOR VERY HIGH CONCENTRATION SYSTEMS
E. Fanetti, C. Flores, and G. Guarini Oct. 1979 17 p refs Presented at 18th Intern. COMPLES Conf. on Solar Energy, New Prospects, Milan, 23-28 Sep. 1979
(CISE-1517) Avail: NTIS HC A02/MF A01

Basic data on design and processing of GaAs-GaAlAs solar cells for high concentration ratios are reported. Conversion efficiencies up to 23% at 100 suns and 17% at 925 suns were measured. The temperature variation of conversion efficiency was also checked up to 200 C and a close correlation between theoretical and experimental results was generally found.
Author (ESA)

N81-12631# European Space Agency, Paris (France).
CONTRIBUTION TO THE STUDY OF THE INTERNAL MECHANICS OF A SPACE PHOTOVOLTAIC GENERATOR [CONTRIBUTION A L'ETUDE DE LA MECANIQUE INTERNE D'UN GENERATEUR PHOTOVOLTAIQUE SPATIAL]
D. C. Richard (ESTEC, Noordwijk, Netherlands) and W. R. Burke, ed. Jan. 1980 64 p refs In FRENCH

(ESA-STR-205; ISSN-0379-4067) Avail: NTIS HC A04/MF A01; ESA, Paris FF 55

A review of the mechanical characteristics and testing procedures of photovoltaic generator assemblies is presented related to the design of solar generators for space applications. Included are properties of materials, analytical study of a half-cell, welding points study, interconnector study and electrical wiring. The impact of theoretical results on manufacturing procedures is discussed. Author (ESA)

N81-12632# Open Univ., Milton (England). Energy Research Group.

PASSIVE SOLAR IN MILTON KEYNES, ENGLAND. A DESCRIPTION OF SOME OF THE MORE NUMERICAL ASPECTS OF THE DESIGN OF AN ESTATE OF LOW ENERGY HOUSES

R. Everett Jul. 1980 152 p refs Prepared in cooperation with Milton Keynes Development Corp.

(ERG-031) Avail: NTIS HC A08/MF A01; Secr. Energy Res. Group, Milton Keynes, England

The numerical aspects of the design of low energy consumption houses using passive solar energy collection and high levels of insulation are described. Two housing energy conservation projects were begun, one involving the construction of 177 low energy houses on a cost-effective basis, and the other involving the detailed monitoring of eight highly insulated passive solar houses. Both experimental data and theoretical analysis are presented, and the relative effectiveness of the various design alternatives are discussed. Author (ESA)

N81-12633# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

APPLICATION OF A METHOD FOR AERODYNAMIC ANALYSIS AND DESIGN OF HORIZONTAL AXIS WIND TURBINES, PART 1

Anders L. Gustafsson, Stig Lundgren, and Boerje Frisk 26 Feb. 1980 74 p refs

(Contract NE-5061-012)

(FFA-TN-AU-1499-Pt-1) Avail: NTIS HC A04/MF A01

The application of a momentum theory method is presented for static performance analysis and for design of blades for horizontal axis wind turbines. The method is based on a combination of blade element and momentum theory. The performance results are presented as power coefficient or shaft power versus windspeed and static blade and turbine loads to be used for structural design. The combination of turbine performance and wind characteristics to obtain annual energy production is treated. The procedure to obtain the chord and twist distribution that maximizes blade performance at a specified wind is described. Numerical results for the Swedish wind power test unit Kalkugnen are presented. Author (ESA)

N81-12634# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.

OPTIMIZED PITCH CONTROLLER FOR LOAD ALLEVIATION ON WIND TURBINES

Brad S. Liebst Stockholm Aeronautical Research Inst. of Sweden 19 Aug. 1980 195 p refs Sponsored in part by MIT Aeronautical Research Foundation

(Contract NE-5061-013)

(FFA-TN-HU-2189-Pt-1) Avail: NTIS HC A09/MF A01

An optimum feedback control law for load alleviation utilizing a pitching blade segment on a wind turbine is developed. The analysis is made for an isolated blade on a completely rigid tower. The blade is assumed to be completely rigid and constrained by three flexible springs. Pitch, flap, and lag blade degrees of freedom are included as well as shaft torsion and generator dynamics. A quasi-steady analysis is used in predicting aerodynamic loads. Gravity loads are included, as well as wind shear and tower shadow effects. The nonlinear equations of motion are linearized by perturbation methods. The controller determined minimizes a penalty integral that is the sum of a quadratic in state perturbations and a quadratic in the control. A FORTRAN program is presented which solves the resulting Riccati equations for the feedback gains. The program developed is used to determine the control law for the NASA-ERDA 100 kW wind turbine considering only the flapping degree of freedom. Author (ESA)

N81-12635# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium). Environmental and Applied Fluid Dynamics Dept.

MEASUREMENT OF THE SOLAR RADIATIVE PROPERTIES OF SILICA GEL

L. N. Connor Jun. 1980 22 p refs

(VKI-TM-29) Avail: NTIS HC A02/MF A01

Techniques were developed for determining the transmittance, reflectance, and absorptance of silica gel beds subjected to simulated solar radiation. The techniques were used to evaluate properties of commercial silica gel samples of both the clear and indicator variety. Results showed the solar radiative properties to be strong functions of bed depth and moisture content. Author (ESA)

N81-12636# National Technical Information Service, Springfield, Va.

ENERGY CONSERVATION: POLICIES, PROGRAMS, AND GENERAL STUDIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Jul. 1980

Audrey S. Hundemann Aug. 1980 143 p Supersedes NTIS/PS-79/0846; NTIS/PS-78/0693

(PB80-813793; NTIS/PS-79/0846; NTIS/PS-78/0693) Avail: NTIS HC$30.00/MF$30.00 CSCL 10A

National policies, programs, and general studies of ways to conserve energy are presented. Topic areas cover such subjects as electric load management, effects of price and taxation on energy conservation, public attitudes and behavior toward energy saving, energy savings through reduction in hot water consumption, and telecommunications substitutability for travel. GRA

N81-12637# National Technical Information Service, Springfield, Va.

ENERGY CONSERVATION: POLICIES, PROGRAMS, AND GENERAL STUDIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978

Audrey S. Hundemann Aug. 1980 249 p

(PB80-813785) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

National policies, programs, and general studies or ways to conserve energy are presented. Topic areas cover such subjects as electric load management, effects of price and taxation on energy conservation, public attitudes and behavior toward energy saving, energy savings through reduction in hot water consumption, and telecommunications substitutability for travel. GRA

N81-12638# National Technical Information Service, Springfield, Va.

FLAT PLATE SOLAR COLLECTOR DESIGN AND PERFORMANCE. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - 1980

Audrey S. Hundemann Sep. 1980 261 p Supersedes NTIS/PS-70/0929; NTIS/PS-78/0841

(PB80-814122; NTIS/PS-79/0929; NTIS/PS-78/0841) Avail: NTIS HC $30.00/MF $30.00

Citations on the design, thermal performance, and optimization of air and liquid type flat plate collectors are covered. Topic areas include heat loss and heat transfer, effect of orientation, corrosion protection, optical coatings, enhancement of performance through the use of planar reflectors, and the effect of honeycomb layers on collector performance. A few studies pertain to grooved, corrugated, or V-trough collectors. Methods of measuring the performance of flat plate collectors and computer optimization studies are included. GRA

N81-12639# National Technical Information Service, Springfield, Va.

FLAT PLATE SOLAR COLLECTOR DESIGN AND PERFORMANCE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jul. 1980

Audrey S. Hundemann Sep. 1980 165 p Supersedes NTIS/PS-79/0928; NTIS/PS-78/0840

(PB80-814130; NTIS/PS-79/0928; NTIS/PS-78/0840) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Federally funded research on the design and thermal efficiency of air and liquid type flat plate collectors is discussed. Topic areas cover convection characteristics, methods to reduce heat loss, optical coatings, and corrosion control. Emphasis of the

bibliography is on basic research studies. This updated bibliography contains 196 citations, 36 of which are new entries to the previous edition. GRA

N81-12640# National Technical Information Service, Springfield, Va.
FUEL CELLS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Jun. 1980
Diane M. Cavagnaro Jul. 1980 144 p Supersedes NTIS/PS-79/0717; NTIS/PS-78/0633
(PB80-813397; NTIS/PS-79/0717; NTIS/PS-78/0633) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Fuel cell applications, components, fabrication, design, catalysts, and chemistry are covered. The bibliography includes different types of fuel cells, such as hydrogen oxygen cells, hydrocarbon air cells, and biochemical cells. This updated bibliography contains 139 citations, 97 of which are new entries to the previous edition. GRA

N81-12641# National Technical Information Service, Springfield, Va.
FUEL CELLS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - 1978
Diane M. Cavagnaro Aug. 1980 198 p
(PB80-813389) Avail: NTIS HC $30.00/MF $30.00 CSCL 10B

Fuel cell applications, components, fabrication, design, catalysts, and chemistry are covered. The citations discuss different types of fuel cells such as hydrogen oxygen cells, hydrocarbon air cells, and biochemical cells. GRA

N81-12642# National Technical Information Service, Springfield, Va.
SOLAR ENERGY CONCENTRATOR DESIGN AND OPERATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1980
Audrey S. Hundemann Sep. 1980 330 p Supersedes NTIS/PS-79/0927; NTIS/PS-78/0839
(PB80-813934; NTIS/PS-79/0927; NTIS/PS-78/0839) Avail: NTIS HC $30.00/MF $30.00 CSCL 10A

Worldwide research on the design and operation of various types of solar energy concentrators is discussed. Topic areas cover thermal and optical performance of Fresnel lenses, compound parabolic concentrators, fixed mirror concentrators, and planar reflector enhancement of flat plate collector systems. A few abstracts deal with V-trough concentrators and methods to calculate performance of concentrators. A separate Published Search on heliostat systems is available. GRA

N81-12643# Insights West, Inc., Los Angeles, Calif.
SOLAR-AUGMENTED APPLICATIONS IN INDUSTRY
John H. Williams, Steven C. Whitney, and Heather Ball Feb. 1980 124 p refs
(GSRI Proj. 5011-343-0105)
(PB80-205313; GRI-78/0036) Avail: NTIS HC A06/MF A01 CSCL 10A

Through 200 field interviews, the process needs of a wide variety of industries were examined and matched to existing solar hardware. Through a screening process using available annual insolation's relationship to process thermal needs, a ranking of the most likely candidates for early entry application of solar was then developed. The institutional aspects of solar's use by industry were examined, as were generic solar collector performance variables. Significant feedback was obtained relative to the attitudes of industrial plane executive concerning solar. GRA

N81-12979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY OVERVIEW
Henry O. Slone *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 1-9
(For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10A

N81-12981*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINES: A UTILITY OPTION FOR THE GENERATION OF ELECTRICITY
William H. Robbins, Ronald L. Thomas, and Darrell H. Baldwin *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 27-41 refs Also presented at the Am. Power Conf., Chicago, 21-23 Apr. 1980 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10B

N81-12989*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DOE PHOTOVOLTAICS PROGRAM
Robert R. Ferber *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 133-143 Sponsored in part by DOE
(For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10A

N81-12990*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR PHOTOVOLTAICS: STAND ALONE APPLICATIONS
James N. Deyo *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 145-156
(For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10A

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-12644# Wyle Labs., Inc., El Segundo, Calif.
NOISE EXPOSURE OF CIVIL AIRCARRIER AIRPLANES THROUGH THE YEAR 2000. VOLUME 1: METHODS, PROCEDURES, RESULTS Final Report, Aug. 1977 - Feb. 1979
Carroll Bartel and Louis C. Sutherland Feb. 1979 141 p refs 2 Vol.
(Contract EPA-68-01-3514)
(EPA-550/9-79-313-1; WR-78-11-Vol-1) Avail: NTIS HC A07/MF A01

A noise prediction model was used to show the possible effectiveness of reducing aircraft noise exposure by modifications to FAR 36 which would progressively lower noise limits for newly designed aircraft, and by using alternative power cutback procedures coupled with minor variations on approach procedures. Exposure was measured in terms of land area and number of people subjected to various levels of noise from L(dn) 60 to 80 db. Subsonic aircraft were emphasized; however, the isolated exposure of only supersonic operations was also analyzed. Results show that the application to subsonic aircraft of the noise technology certification rules for 1980 and 1985 proposed by EPA will show a substantial decrease in noise exposure in future years but the result will not be felt until well beyond the year 2000. A more immediate achievement noise reduction is possible by using an improved takeoff procedure. The proposed ALPA/NWA Max Cutback procedure offers additional noise reduction on an average for the nation's airports over that provided by the AC91-30 procedure for current technology aircraft. A.R.H.

N81-12645# Wyle Labs., Inc., El Segundo, Calif.
NOISE EXPOSURE OF CIVIL AIRCARRIER AIRPLANES THROUGH THE YEAR 2000. VOLUME 2: APPENDICES A THROUGH F Final Report, Aug. 1977 - Feb. 1979
Carroll Bartel and Louis C. Sutherland Feb. 1979 296 p refs 2 Vol.
(EPA-550/9-70-313-2; WR-78-11-Vol-2) Avail: NTIS HC A13/MF A01

Airports with more than 10 jet departures per year are listed and procedures are given for forecasting the moderate and expansive growth of civil air carriers to the year 2000. Graphs show the noise characteristics and assumed performance characteristics for each aircraft classification studied. The expected range in noise exposure to the year 2000 due to supersonic aircraft operations is analyzed for various scenarios. The impact

of both the average airport and at the nations level for all aircraft classifications examined is forecasted. A.R.H.

N81-12646*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH-VOLTAGE SPARK CARBON-FIBER STICKY-TAPE DATA ANALYZER
Lien C. Yang and Glen G. Hull 15 Jun. 1980 60 p refs (Contract NAS7-100)
(NASA-CR-163747; JPL-Pub-80-55) Avail: NTIS HC A04/MF A01 CSCL 13B

An efficient method for detecting carbon fibers collected on a stick tape monitor was developed. The fibers were released from a simulated crash fire situation containing carbon fiber composite material. The method utilized the ability of the fiber to initiate a spark across a set of alternately biased high voltage electrodes to electronically count the number of fiber fragments collected on the tape. It was found that the spark, which contains high energy and is of very short duration, is capable of partially damaging or consuming the fiber fragments. It also creates a mechanical disturbance which ejects the fiber from the grid. Both characteristics were helpful in establishing a single discharge pulse for each fiber segment. R.C.T.

N81-12647*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS OF AIR QUALITY MANAGEMENT WITH EMPHASIS ON TRANSPORTATION SOURCES
Thomas D. English, Edward Divita, and Lester Lees 15 Oct. 1980 193 p refs Sponsored in part by DOT
(Contract NAS7-100)
(NASA-CR-163746; JPL-Pub-80-65) Avail: NTIS HC A09/MF A01 CSCL 13B

The current environment and practices of air quality management were examined for three regions: Denver, Phoenix, and the South Coast Air Basin of California. These regions were chosen because the majority of their air pollution emissions are related to mobile sources. The impact of auto exhaust on the air quality management process is characterized and assessed. An examination of the uncertainties in air pollutant measurements, emission inventories, meteorological parameters, atmospheric chemistry, and air quality simulation models is performed. The implications of these uncertainties to current air quality management practices is discussed. A set of corrective actions are recommended to reduce these uncertainties. M.G.

N81-12648# Committee on Interstate and Foreign Commerce (U. S. House).
CLEAN AIR ACT-AMENDMENTS OF 1977: OVERSIGHT
Washington GPO 1980 54 p Hearing before the Subcomm. on Oversight and Invest. of the Comm. on Interstate and Foreign Com., 96th Congr., 1st Sess., 9 Apr. 1979
(GPO-63-136)

The role of the Council on Wage and Price Stability in relation to the Tennessee Vally Authority - Environmental Protection Agency air cleanup consent decree is examined. S.F.

N81-12649# Joint Economic Committee (U. S. Congress).
THE IMPACT OF AN ACCELERATED COAL-BASED SYNFUELS PROGRAM ON WESTERN WATER RESOURCES
Washington GPO 1980 108 p refs Avail: SOD HC
(GPO-61-316)

Effects of an accelerated synthetic fuels program on the water resources of the northern Great Plains are discussed. S.F.

N81-12650# Pacific Missile Range, Point Mugu, Calif. Geophysics Div.
SUMMARY OF PACIFIC MISSILE TEST CENTER METEOROLOGICAL SUPPORT AIR QUALITY ASSESSMENT MODEL (AQAM) TESTS AT THE NAVAL AIR STATION, MIRIMAR, 1 TO 8 AUGUST 1979
Y. K. Yamamura, R. A. Helvey, W. W. Choate, D. Musquiz, M. Bahu, and J. Rosenthal Sep. 1980 92 p refs
(AD-A090529; PMTC-TP-80-22) Avail: NTIS HC A05/MF A01 CSCL 04/2

This report sumarizes the PACMISTESTCEN support for the Air Quality Assessment Model evaluation tests at NAS Miramar, which consisted in planning of measurement periods; operational day-to-day forecasts; surface and upper air measurements using high resolution modified rawinsondes; onsite and post operational data evaluation, reduction and analysis; and meteorological interpretation services. GRA

N81-12651# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
USAF AIRCRAFT ENGINE EMISSION GOALS, A CRITICAL REVIEW Final Report, Sep. 1978 - Jun. 1979
Richard W. Boubel and Joseph A. Martone Sep. 1979 114 p refs
(AF Proj. 1900)
(AD-A090282; AFESC/ESL-TR-79-30) Avail: NTIS HC A09/MF A01 CSCL 21/5

This report is a comprehensive summary and analysis of proposed aircraft turbine engine air pollution regulations and their relevance to the USAF. Existing USAF aircraft turbine engine emission goals are critically reviewed, and revised goals are proposed. The original goals contained emission standards and compliance dates; the proposed goals contain neither. The authors believe that the goals should be set to provide an incentive for emission reduction and should not be numerical standards and dates, which may or may not be met. The proposed USAF goals cover the critical turbine engine emissions. Carbon monoxide and oxides of sulfer are not considered serious problems at today's emission levels, while smoke and hydrocarbon emissions appear to warrant the highest priority for reduction. Although cost effective oxides of nitrogen control (NO sub x) is viewed with pessimism, it is concluded that NO sub x reduction deserves continued USAF research. GRA

N81-12652# Air Force Engineering and Services Center, Tyndall AFB, Fla. Engineering and Services Lab.
THE IMPLICATIONS OF ALTERNATIVE AVIATION FUELS ON AIRBASE AIR QUALITY Final Report, Nov. 1977 - Aug. 1980
Harold A. Scott, Jr. Aug. 1980 48 p refs
(AF Proj. 2103)
(AD-A090283; AFESC/ESL-TR-80-38) Avail: NTIS HC A02/MF A01 CSCL 21/4

Aircraft alternative fuel emission factors from turbine engine combustor performance tests are integrated into the Air Quality Assessment Model (AQAM) to predict the air quality impact of alternative fuels use in the vicinity of Air Force bases. AQAM computes the alternative fuel emission factors from fuel property inputs, enabling the model to predict concentrations for any proposed alternative fuel blend. In addition to aircraft alternative fuel emissions calculations, AQAM was modified to calculate alternative fuel handling and breathing loss emissions from the fuel properties. Using AQAM with two aircraft engine models, the aircraft alternative fuel annual emissions and resulting short-term pollutant concentrations are computed for a typical Air Force base. The analysis indicates that alternative fuel emissions cause a slight increase in pollution concentrations when compared with the baseline JP-4 fuel. A reduction of evaporative hydrocarbon emissions is predicted due to the alternative fuels' lower volatility in comparison with JP-4. GRA

N81-12653# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
AN AUTOMATIC ISOKINETIC SAMPLER FOR PARTICULATE EMISSIONS FROM AIRCRAFT GAS TURBINE ENGINES Final Report, Feb. 1975 - Jun. 1978
Hans Joachim Dehne Jan. 1980 37 p refs Sponsored in part by ESL
(Contract N00123-75-C-1075; AF Proj. 1900)
(AD-A090280; ACUREX-78-315; AFESC/ESL-TR-80-04; AESO-161-01-80) Avail: NTIS HC A03/MF A01 CSCL 14/2

An automated isokinetic sampler for evaluating particulate emissions from aircraft gas turbine engines was designed, constructed and tested. The sampler is capable of collecting the particulate mass emitted by an aircraft gas turbine at the exit plane (non-afterburner operation) for gravimetric measurements and permits simultaneous on-line particle size distribution measurements to be performed. The particulate is collected on a fiber glass filter for gravimetric measurement. The size

distribution is determined by conditioning the gas turbine exhaust gases and passing them through a mobility particulate size distribution analyzer. The sampler has two-axis traverse capability and a maximum sampling capability of 226 1/min (8 scfm). Test data are automatically recorded. Control of the sampler is by means of 12 bit microprocessor. Preliminary tests were performed at the Naval Air Rework Facility, Alameda, California, at various construction stages of the sampler to evaluate its performance and to measure the effects of fuel additives on particulate emissions on a TF41 gas turbine engine. GRA

N81-12654# Oak Ridge National Lab., Tenn. Engineering Technology Div.

TRACKING OF SMOKESTACK AND COOLING TOWER PLUMES USING WIND MEASUREMENTS AT DIFFERENT LEVELS

R. L. Miller and A. A. N. Patrinos Aug. 1980 10 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7417) Avail: NTIS HC A02/MF A01

Relationships between cooling tower and smokestack plumes at an electric generating plant and wind direction measurements at levels from the surface at 850 mb (approximately 1.5 km) are examined. The wind measurements play an important role in estimating plume directions which in turn are utilized to establish control and target (upwind and downwind) areas for a study of plant induced precipitation modification. Fifty-two plume observations were made during a three week period. Results indicate that a windset (4.5 km from the plant) mounted at a level approximating that of the cooling tower plume is a better predictor of plume direction than surface windsets (1.0 km from the plant) or 850 mb level winds. However, an apparent topographical influence on the wind direction measurements at the plume level windset site somewhat limits its plume tracking capability, at least for ambient winds from the SW quadrant. DOE

N81-12655# Department of Energy, Washington, D. C. Assistant Secretary for Resource Applications.

ENVIRONMENTAL ASSESSMENT: GEOTHERMAL DIRECT HEAT PROJECT, MARLIN, TEXAS

Aug. 1980 68 p refs
(DOE/EA-0117) Avail: NTIS HC A04/MF A01

The Federal action addressed by this environmental assessment is joint funding the retrofitting of a heating and hot water system in a hospital at Marlin, Texas, with a geothermal preheat system. The project will be located within the existing hospital boiler room. One supply well was drilled in an existing adjacent parking lot. It was necessary to drill the well prior to completion of this environmental assessment in order to confirm the reservoir and to obtain fluids for analysis in order to assess the environmental effects of fluid disposal. Fluid from operation will be disposed of by discharging it directly into existing street drains, which will carry the fluid to Park Lake and eventually the Brazos River. Environmental impacts of construction were small because of the existing structures and paved areas. Construction run off and geothermal flow test fluid passed through a small pond in the city park, lowering its water quality, at least temporarily. Construction noise was not out of character with existing noises around the hospital. DOE

N81-12656# Argonne National Lab., Ill. Integrated Assessments and Policy Evaluation Group.

IN PURSUIT OF CLEAN AIR: A DATA BOOK OF PROBLEMS AND STRATEGIES AT THE STATE LEVEL. VOLUME 3: FEDERAL REGIONS 4 AND 6

D. B. Garvey and D. G. Streets Feb. 1980 338 p refs
(Contract W-31-109-eng-38)
(ANL/EES-TM-90-Vol-3) Avail: NTIS HC A15/MF A01

Possible areas of conflict between the implementation of a national energy policy calling for the increased use of coal and the pursuit of clean air are examined. Information is presented for each state in Federal regions 4 and 6 under the following section headings: state title page (includes a summary of air quality data); revised state implementation plan outline; maps of nonattainment areas, as designated; storage and retrieval of aerometric data; SAROAD data maps; power plant data; power plant maps; and county maps. States in Federal region 4 include Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee. Those in Federal region 6 include Arkansas, Louisiana, New Mexico, Oklahoma, and Texas. DOE

N81-12657# Colorado State Univ., Fort Collins.

PLANETARY-WAVE BEHAVIOR AND ARCTIC AIR POLLUTION

E. R. Reiter 1979 154 p refs Presented at Graduate School of Oceanog., Kingston, R.I.
(Contract DE-AS02-76EV-01340)
(DOE/EV-01340/T2) Avail: NTIS HC A05/MF A01

An attempt was made to relate episodes of air pollution at Barrow, Alaska, containing vanadium, to the behavior of planetary waves in middle and high latitudes. A stationary index for planetary waves is defined as the ratio between amplitudes computed from monthly mean maps and the mean amplitudes computed on a daily basis and averaged over the same month, irrespective of phase angle. Longitude-time sections of 500 mb height anomalies at various latitudes are related to vanadium pollution episodes at Barrow. DOE

N81-12658# Mitre Corp., McLean, Va. Metrek Div.

GEOTHERMAL ENERGY ENVIRONMENTAL PROBLEMS AND CONTROL METHODS: REVIEW OF RECENT FINDINGS

Van Thanh Nguyen, John F. Caskey, Richard T. Pfundstein, and Susan B. Rifkin Jun. 1980 72 p refs
(Contract DE-AC01-79ET-27224)
(DOE/ET-27224/T1; MTR-80W108) Avail: NTIS HC A04/MF A01

The findings of a literature review on the environmental concerns and associated control methods of geothermal energy utilization are presented. Environmental problems associated with geothermal energy utilization are introduced; the current status of control methods are assessed; appropriate environmental documents; and areas where additional environmental research is needed are identified. The review attempts to consolidate current understanding of the environmental impact of geothermal energy development. Reports written by authors in industry, government and academia were reviewed in the areas of air emissions, surface and subsurface liquid discharges, solid wastes, noise, subsidence, and induced seismicity. DOE

N81-12659# Environmental Resources Group, Los Angeles, Calif.

PROTOTYPE ENVIRONMENTAL ASSESSMENT OF THE IMPACTS OF SITING AND CONSTRUCTING A SATELLITE POWER SYSTEM (SPS)

Aug. 1980 272 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0072) Avail: NTIS HC A12/MF A01

The study objectives were: (1) to develop a comprehensive prototype assessment of the nonmicrowave related impacts on the natural and human environments of the reference system SPS GRS; (2) to assess the impacts of GRS construction and operations in the context of actual baseline data for a site in the California desert which, while it has not been selected as eligible for GRS siting, has many features that are optimal for SPS; and (3) to identify critical GRS characteristics or parameters that are most significant in terms of both the natural and human environment. Critical project parameters revealed include: the sheer size and intensity of use of the contiguous land area required by an SPS GRS; the lack of flexibility in siting individual rectenna structures once the rectenna boundaries are established; the difficulties in finding suitable sites that do not conflict with other societal needs and values; uncertainties relating to reestablishing native ecosystems following total ecosystem modification during construction, and the related need for further research into microclimatic effects near the ground surface beneath the rectenna panels. DOE

N81-12660# Oak Ridge National Lab., Tenn. Information Div.

REVIEWS OF THE ENVIRONMENTAL EFFECTS OF POLLUTANTS: IX, FLUORIDE

J. S. Drury, J. T. Ensminger, A. S. Hammons, J. W. Holleman, E. B. Lewis, E. L. Preston, C. R. Shriner, and L. E. Towill Sep. 1980 458 p refs
(Contract W-7405-eng-26)
(ORNL/EIS-85; EPA-600/1-78-050) Avail: NTIS

HC A20/MF A01

A comprehensive, multidisciplinary review of the health and environmental effects of fluoride on microorganisms, plants, wild and domestic animals, and humans is presented. Human intake of fluoride is chiefly through the diet; drinking water is normally the largest single source. Low concentrations of fluoride in water (approximately 1 ppM) benefit mammalian systems, making bone and tooth apatite less soluble, but long term ingestion of water containing more than 8 ppM fluoride causes fluorosis in humans. Fluoride salts are lethal to humans when ingested in doses of about 3 g or more. At concentrations normally encountered by the general public, fluoride is not teratogenic, mutagenic, or carcinogenic to humans, but chronic fluoride toxicosis of both livestock and wildlife is an important problem in many areas of the United States. The principal manifestations of chronic fluoride toxicosis in livestock are dental fluorosis, osteofluorosis, lameness, and impaired performance. DOE

N81-12661# Brookhaven National Lab., Upton, N. Y.

PROCEEDINGS OF THE INTERNATIONAL WORKSHOP OF THE EFFECTS OF ACID PRECIPITATION VEGETATION, SOILS, AND TERRESTRIAL ECOSYSTEMS

Lance S. Evans, ed. and George R. Hendrey, ed. 1979 59 p refs Presented at Brookhaven Natl. Lab., Upton, N. Y., 12-14 Jun. 1979

(Contracts EPA-79-07-0681; DE-AC02-76CH-00016) (BNL-51195; ECTES-TID-4500) Avail: NTIS HC A04/MF A01

Acid rain at extreme ambient levels, or in artificial systems that simulate extreme ambient levels, causes injury to plant tissues. A major area of concern of acid rain injury was thought to be plant reproduction. The overall levels of significance of plant injury among various plant species remain unknown. The most important priorities in the area of effects of acid rain on crops were (a) an evaluation of effects on crop yields and (b) interaction of acid rain in combination with pollutants on various plants. Few participants thought that ambient acid rain loadings altered soils to such a degree that plants are affected at present, but many thought that acid rain could cause some alterations in soils. The most important research priorities were in the areas of the effects of acid rain on (a) increased leaching of exchangeable plant nutrients and (b) alterations in phosphorous availability. All participants agreed that there are alterations in terrestrial ecosystems from acid precipitation. However, no demonstrated harmful effects were presented from natural ecosystems. Author

N81-12662# Brookhaven National Lab., Upton, N. Y. National Center for Analysis of Energy Systems.

ENERGY-ENVIRONMENTAL IMPACTS OF FIVE ENERGY CONSERVATION MEASURES IN THE MIDDLE ATLANTIC AND PACIFIC STATES

P. D. Moskowitz, E. Edelson (Pacific Northwest Lab.), T. Q. Le, W. A. Sevian, J. E. Smith, and A. Struth Oct. 1979 76 p refs

(BNL-51110) Avail: NTIS HC A05/MF A01

Estimates of some energy and environmental impacts for five different energy conservation measures (district heating, industrial cogeneration, retrofit, rate reform, and vehicle redesign) were prepared for two different regions (Middle Atlantic and Pacific) and two different time periods (1985 and 2000) based upon data presented in regional reference energy systems developed at Brookhaven National Laboratory. Results of the analysis indicate that regional energy use can be reduced by 1 to 6%. Vehicle redesign produces the greatest oil savings. Retrofit and district heating can each reduce oil and natural gas use. Industrial cogeneration can significantly reduce use of fuels consumed in central station electricity production (e.g., coal and nuclear) but at an energy penalty incurred by industry: increased dependence on oil and natural gas could result. Rate reform and retrofit each reduce emissions production in rough proportion to the quantities of energy saved. Vehicle redesign reduces only supply sector emissions; end-use emissions are not affected even though gasoline use significantly decreases. District heating may reduce regional emissions but increase local emission burdens where waste heat is being produced. Author

N81-12663# Brookhaven National Lab., Upton, N. Y. Land and Freshwater Environmental Sciences Group.

GEOLOGICAL AND HYDROCHEMICAL SENSITIVITY OF THE EASTERN UNITED STATES TO ACID PRECIPITATION

George R. Hendrey, James N. Galloway, Stephen A. Norton, Carl L. Schofield, Paul W. Shaffer, and Douglas A. Burns Mar. 1980 100 p refs Prepared for EPA, Washington, D.C. Prepared in cooperation with Virginia Univ., Charlottesville, Maine Univ., Orono and Cornell Univ., Ithaca, N.Y.

(Contract DE-AC02-76CH-00016) (BNL-51189; TID-4500; EPA-600/3-80-024) Avail: NTIS HC A05/MF A01

An analysis of bedrock geology maps of the eastern U.S. constitutes a simple model for predicting areas which might be impacted by acid precipitation and it allows much greater resolution for detecting sensitivity than was previously available for the region. Map accuracy was verified by examining current alkalinities and pH's of waters in several test states, including Maine, New Hampshire, New York, Virginia and North Carolina. In regions predicted to be highly sensitive, alkalinities in upstream sites were generally low. Many areas of the eastern U.S. are pinpointed in which some of the surface waters, especially upstream reaches, may be sensitive to acidification. Pre-1970 data were compared to post-1975 data, revealing marked declining in both alkalinity and pH of sensitive waters of two states tested, North Carolina, where pH and alkalinity have descreased in 80% of 38 streams and New Hampshire, where pH in 90% of 49 streams and lakes has decreased since 1949. Author

N81-12664# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Atmospheric Pollution Div.

MEASURING PARTICULATE AIR POLLUTION

L. Brasser 1979 6 p

(IG-Publ-638) Avail: NTIS HC A02/MF A01

The properties of gaseous and particulate pollutants are compared, and the resultant differences in measuring techniques described. The problems of establishing reference methods are reviewed, using lead as an example. It is argued that it is more useful to describe standard methods for the determination of special pollutants, or for the determination of special properties of the total particulate pollution, than to speak of reference methods. The use of microscopy for identifying particle sources is mentioned. Author (ESA)

N81-12665# National Technical Information Service, Springfield, Va.

AIR QUALITY MONITORING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - 1978

Diane M. Cavagnaro Jul. 1980 221 p

(PB80-813462) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Major studies on air pollution monitoring, including site selection, operation criteria, design criteria, calibration, and performance evaluation of the technique or equipment are discussed. Different types of pollutants from various sources are covered. GRA

N81-12666# National Technical Information Service, Springfield, Va.

AIR QUALITY MONITORING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1979 - Jun. 1980

Diane M. Cavagnaro Aug. 1980 130 p Supersedes NTIS/PS-79/0794; NTIS/PS-78/0758

(PB80-813470; NTIS/PS-79/0794; NTIS/PS-78/0758) Avail: NTIS HC $30.00/MF $30.00 CSCL 14B

Major studies on air pollution monitoring, including site selection, operation criteria, design criteria, calibration, and performance evaluation of the technique or equipment are discussed. Different types of pollutants from various sources are covered in approximately 125 abstracts, 89 of which are new entries to the previous edition. GRA

N81-12667# National Technical Information Service, Springfield, Va.

AIRPORT NOISE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980

Guy E. Habercom, Jr. Jul. 1980 290 p refs Supersedes NTIS/PS-79/0878; NTIS/PS-78/0807

(PB80-813231; NTIS/PS-79/0878; NTIS/PS-78/0807) Avail: NTIS HC $30.00/MF $30.00 CSCL 13B

Aircraft created noise, noise intensity, noise exposure, and physiological effects, all in airport environments, are investigated in these research reports. This updated bibliography contains 285 citations, 20 of which are new entries to the previous edition. GRA

N81-12668# National Commission on Air Quality, Washington, D.C.

REPORT TO THE NATIONAL COMMISSION OF AIR QUALITY ON THE BENEFIT METHODOLOGY EVALUATION PANEL Final Report

Gordon Brady May 1980 18 p refs

(PB80-208390; AQ-100) Avail: NTIS HC A02/MF A01 CSCL 06E

The panel was convened to evaluate methods for the estimation of benefits resulting from enhanced air quality. The relative merits of alternative approaches taken in major studies for estimating benefits of air pollution control were assessed. The panel focused on human health issues and recommended that the commission review major macroepidemiological studies; that standardized methods of measuring morbidity be developed; and that the commission should not include benefit estimates in its regional studies. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-12669*# Ohio State Univ., Columbus.

ACCURACY OF THE DETERMINATION OF MEAN ANOMALIES AND MEAN GEOID UNDULATIONS FROM A SATELLITE GRAVITY FIELD MAPPING MISSION

Christopher Jekeli and Richard H. Rapp Aug. 1980 22 p refs

(Grant NGR-36-008-161)

(Rept-307) Avail: NTIS HC A02/MF A01 CSCL 08G

Improved knowledge of the Earth's gravity field was obtained from new and improved satellite measurements such as satellite to satellite tracking and gradiometry. This improvement was examined by estimating the accuracy of the determination of mean anomalies and mean undulations in various size blocks based on an assumed mission. In this report the accuracy is considered through a commission error due to measurement noise propagation and a truncation error due to unobservable higher degree terms in the geopotential. To do this the spectrum of the measurement was related to the spectrum of the disturbing potential of the Earth's gravity field. Equations were derived for a low-low (radial or horizontal separation) mission and a gradiometer mission. For a low-low mission of six month's duration, at an altutide of 160 km, with a data noise of plus or minus 1 micrometers sec for a four second integration time, we would expect to determine 1 deg x 1 deg mean anomalies to an accuracy of plus or minus 2.3 mgals and 1 deg x 1 deg mean geoid undulations to plus or minus 4.3 cm. A very fast Fortran program is available to study various mission configurations and block sizes. Author

N81-12670 Institut d'Aeronomie Spatiale de Belgique, Brussels.

EFFECT OF ENVIRONMENTAL FLUCTUATIONS ON GLOBAL ENERGY BALANCE OF THE EARTH-ATMOSPHERE SYSTEM

C. Nicolis and G. Nicolis (Brussels Univ.) 1979 15 p refs Submitted for publication

(Aeronomica-Acta-A-206-1979) Avail: Issuing Activity

The effect of environmental fluctuations on the planetary surface temperature is analyzed. Various parameters influencing the energy balance equation are represented as a Gaussian white noise. The resulting stochastic differential equation shows a general tendency for runaway to lower surface temperature values. Author (ESA)

N81-12671 Institut d'Aeronomie Spatiale de Belgique, Brussels.

A MICROSCOPIC DESCRIPTION OF INTERPENETRATED PLASMA REGIONS

M. Roth 1979 53 p refs Presented at Sidney Chapman Conf. on Magnetospheric Boundary Layers, Alpbach, Austria, 11-15 Jun. 1979

(Aeronomica-Acta-A-209-1979) Avail: Issuing Activity

A model of steady-state tangential discontinuities was developed using the kinetic theory of multicomponent collisionless plasmas. In the momenta plane the velocity distribution functions are combined step functions of two anisotropic displaced Maxwellians whose first moments are identical with the actual asymptotic moments. The magnetopause layer and the inner edge of the plasma boundary layer are considered as regions where two different hydrogen plasmas are interpenetrated. The model is used to describe their microstructures. Large field aligned currents are generated at the magnetopause and constitute a part of the field aligned currents observed in the cusps. A stability study shows that the electron layers are nearly always unstable. The thickness of stable ion layers increases with increasing values of the temperature ratio and/or with decreasing density variations. Author (ESA)

N81-12672 Institut d'Aeronomie Spatiale de Belgique, Brussels.

ON EDDY DIFFUSION COEFFICIENTS

G. Brasseur 1980 67 p refs Presented at NATO Adv. Inst. on Atmospheric Ozone, Albufeiras, Portugal, 2-13 Oct. 1979

(Aeronomica-Acta-A-212-1980) Avail: Issuing Activity

Atmospheric transport by eddies in the stratosphere and its parameterization in atmospheric models is discussed. The eddy diffusion concept is shown to be very convenient for aeronomical calculations since it leads to satisfactory distributions of minor constituents. However, this is not demonstrated theoretically. Therefore, eddy diffusion coefficients are deduced from the distribution of several trace species and have to be considered as phenomenological parameters. Author (ESA)

N81-12673 Institut d'Aeronomie Spatiale de Belgique, Brussels.

NITRIC OXIDE COOLING IN THE TERRESTRIAL THERMOSPHERE

G. Kockarts 1980 18 p refs Submitted for publication

(Aeronomica-Acta-A-214-1980) Avail: Issuing Activity

A simple formulation of nitric oxide cooling by emission in the 5.3 micron fundamental band in the terrestrial thermosphere indicates that this process is an important mechanism, necessary in formulating thermospheric models. Calculations show that the cooling effect is highly variable as a consequence of its strong temperature dependence and of its observed variability with the nitric oxide concentration. The infrared emission is never in local thermodynamic equilibrium above 120 km altitude, while predominant cooling probably occurs during NO auroral enhancements. Author (ESA)

N81-12674 Institut d'Aeronomie Spatiale de Belgique, Brussels.

STRATOSPHERIC LAYERING PHOTOGRAPHED

M. Ackerman and C. Lippens 1979 24 p refs Original contains color illustrations

(Aeronomica-Acta-C-54-1979) Avail: Issuing Activity

Photographs of the Earth limb were made from a balloon gondola at an altitude of 31.5 km. They reveal structures in the stratospheric aerosol visible as scattered sunlight. Meteorological information obtained simultaneously is also presented. Two types of layering seem to exist. The first is related to temperature and to wind vertical structures and reflects variations with height of the aerosol abundance. The second relates only to wind structure, reflecting smaller, transient, density variations due to atmospheric waves. Author (ESA)

N81-12675*# Georgia Inst. of Tech., Atlanta. School of Physical Sciences.

THE MOTION AND DISPERSION OF VOLCANIC EMISSIONS FROM LA SOUFRIERE INJECTED INTO THE STRATOSPHERE Final Technical Report, 1 Aug. 1979 - 31 Jul. 1980

D. Cunnold and M. Pitts Sep. 1980 20 p refs

(Grant NsG-1643)

(NASA-CR-163788) Avail: NTIS HC A02/MF A01 CSCL 08K

Atmospheric particles resulting from the eruptions of the La Soufriere volcano in April, 1979 were detected from GOES satellite photographs, from an airborne lidar, and by the SAGE satellite. In order to support the probable detection by SAGE, the meteorological situation in the Eastern Caribbean at the time of these eruptions was investigated. The likely motion and spreading of emissions were assessed. Author

N81-12676*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THEORETICAL REGIME DIAGRAMS FOR THERMALLY DRIVEN FLOWS IN A BETA-PLANE CHANNEL IN THE PRESENCE OF VARIABLE GRAVITY
J. E. Geisler (Miami Univ., Fla.) and W. W. Fowlis Nov. 1980 16 p refs
(NASA-TM-78316) Avail: NTIS HC A02/MF A01 CSCL 04A

The effect of a power law gravity field on baroclinic instability is examined, with a focus on the case of inverse fifth power gravity, since this is the power law produced when terrestrial gravity is simulated in spherical geometry by a dielectric force. Growth rates are obtained of unstable normal modes as a function of parameters of the problem by solving a second order differential equation numerically. It is concluded that over the range of parameter space explored, there is no significant change in the character of theoretical regime diagrams if the vertically averaged gravity is used as parameter. Author

N81-12677*# Dayton Univ., Ohio.
EFFECT OF RAWINSONDE ERRORS ON ROCKETSONDE DENSITY AND PRESSURE PROFILES: AN ERROR ANALYSIS OF THE RAWINSONDE SYSTEM
James K. Luers Jan. 1980 51 p refs
(NASA-CR-156873) Avail: NTIS HC A04/MF A01 CSCL 04A

An initial value of pressure is required to derive the density and pressure profiles of the rocketborne rocketsonde sensor. This tie-on pressure value is obtained from the nearest rawinsonde launch at an altitude where overlapping rawinsonde and rocketsonde measurements occur. An error analysis was performed of the error sources in these sensors that contribute to the error in the tie-on pressure. It was determined that significant tie-on pressure errors result from radiation errors in the rawinsonde rod thermistor, and temperature calibration bias errors. To minimize the effect of these errors radiation corrections should be made to the rawinsonde temperature and the tie-on altitude should be chosen at the lowest altitude of overlapping data. Under these conditions the tie-on error, and consequently the resulting error in the Datasonde pressure and density profiles is less tha 1%. The effect of rawinsonde pressure and temperature errors on the wind and temperature versus height profiles of the rawinsonde was also determined. J.M.S.

N81-12678*# *National Aeronautics and Space Administration.* Goddard Space Flight Center, Greenbelt, Md.
A DESCRIPTION OF THE NSSL CASES USED FOR A *SIMULATED VAS RETRIEVAL STUDY*
Anthony Mostek, Louis W. Uccellini, and Wally Gross Oct. 1980 38 p refs Prepared in cooperation with Computer Sciences *Corp., Silver Spring, Md.*
(NASA-TM-82023) Avail: NTIS HC A03/MF A01 CSCL 04A

A documentation of eight National Severe Storm Laboratory severe storm cases, which serve as a basis for a simulated VISSR Atmospheric Sounder retrieval study, is presented in this *paper. Six of the selected cases provide a control data set to* complete the statistical information needed for retrieval techniques based upon the use of regression matrices. The other two cases *are to be used in the actual retrieval experiments.* The selection was based upon the presence of moisture gradients in the analysis region, the availability of satellite images at the selected time periods, and the extent of cloud cover within the observing network. Author

N81-12679*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE AERONOMY OF VIBRATIONALLY EXCITED OZONE
J. E. Frederick and J. E. Allen, Jr. Oct. 1980 25 p refs
(NASA-TM-82025) Avail: NTIS HC A02/MF A01 CSCL 04A

Theoretical calculations show that above 80 km in the earth's atmosphere the production of vibrationally excited ozone by chemical processes leads to number densities which are usually larger than those expected for local thermodynamic equilibrium. Quenching of highly excited molecules produced in O+O2+M, O3+M provided a significant source of the lower lying states above the mesopause while the 9.6 microns emission of O3 (0,0,1) was a major sink. Analysis of available laboratory results implied that reactions involving excited ozone play a significant role in the global ozone balance despite the relatively small abundance of the molecule. However, this effect is implicit in many of the rate coefficients currently used in stratospheric calculations. In the upper mesosphere and lower thermosphere, where the excited state populations differ from those for thermal equilibrium, published reaction rate data are not necessarily applicable to aeronomic calculations. Author

N81-12680*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL DYNAMICS PROJECT OBSERVING PLAN FOR HIGHLY MOBILE SYSTEMS 1981 - 1986
Herbert Frey Oct. 1980 42 p refs
(NASA-TM-82029) Avail: NTIS HC A03/MF A01 CSCL 08G

Measurement of crustal motion in the western United States and other tectonically active regions makes use of fixed, movable and highly mobile satellite laser ranging and very long baseline interferometry systems. Measurement of the rotational dynamics of the Earth as well as regional deformation and plate motion are discussed. S.F.

N81-12681*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGETICS OF THE MAGNETOSPHERE
David P. Stern Nov. 1980 15 p *Presented at the AGU Fall* Meeting, San Francisco, 8-12 Dec. 1980
(NASA-TM-82039) Avail: NTIS HC A02/MF A01 CSCL 04A

The approximate magnitudes of several power inputs and energies associated with the Earth's magnetosphere will be *derived. They include: Solar wind power impinging on the dayside* magnetopause approximately 1.4 10 to the 13th power watt; power input to cross tail current approximately 3 10 to the *11th power watt;* energy of moderate magnetic storm approximately 2 10 to the 15th power joule; power related to the *flow of j approximately 1 to 3 10 to the 11th power watt:* average power deposited by the aurora approximately 2 10 to the 10th power watt. Stored magnetic energy: released in a *substorm approximately 1.5 10 to the 14th power joule. Compared* to the above, the rate at which energy is released locally in magnetospheric regions where magnetic merging occurs is *probably small. Merging is essential, however, for the existence* of open field lines, which provide the most likely explanation for some major energy inputs listed here. Merging is also required *if part of the open flux of the tail lobes is converted into closed* flux, as seems to happen during substorms. Again, most of the energy release becomes evident only beyond the merging region, *though some particles may gain appreciable energy in that region* itself, if the plasma sheet is completely squeezed out and the high latitude lobes interact directly. Author

N81-12682*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INITIAL ASSESSMENT OF THE EFFECTS OF ENERGETIC ION INJECTIONS IN THE MAGNETOSPHERE DUE TO THE *TRANSPORT OF SATELLITE POWER SYSTEM COMPO*-NENTS FROM LOW EARTH ORBIT TO GEOSYNCHRONOUS EARTH ORBIT
S. A. Curtis and J. M. Grebowsky Jul. 1980 33 p *refs*
(DE-AI02-80CH-10048)
(NASA-TM-81982) Avail: NTIS HC A03/MF A01 CSCL 04A

Potentially serious environmental effects exist when cargo orbital transfer vehicle (COTV) ion propulsion is used on the *scale proposed in the preliminary definition studies of the Satellite* Power System. These effects of the large scale injections of ion

propulsion exhaust in the plasmasphere and in the outer magnetosphere were shown to be highly model dependent with major differences existing in the predicted effects of two models, the ion cloud model and the ion sheath model. The expected total number density deposition of the propellant Ar(+) in the plasmasphere, the energy spectra of the deposited Ar(+) and time dependent behavior of the Ar(+) injected into the plasmasphere by a fleet of COTV vehicles differ drastically between the two models. The ion sheath model was demonstrated to be applicable to the proposed Ar(+) beam physics if the beam was divergent and turbulent whereas the ion cloud model was not a realistic approximation for such a beam because the 'frozen-field' assumption on which it is based is not valid.Author

N81-12683*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.

REDUCTION AND ANALYSIS OF ATS-6 DATA Final Report, 1 Nov. 1978 - 30 Jun. 1979

G. A. Paulikas and J. B. Blake 1 Jun. 1979 29 p refs
(Contract NAS5-23788)
(NASA-CR-160052; ATR-79(7642)-3) Avail: NTIS HC A03/MF A01 CSCL 04A

The scientific and technological results obtained by an energetic particle spectrometer are summarized. Data on energetic electrons trapped in the Earth's radiation belt near synchronous altitude and on solar particles penetrating to this altitude are discussed. S.F.

N81-12684*# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

A GLOBAL MODEL OF THE NEUTRAL THERMOSPHERE IN MAGNETIC COORDINATES BASED ON AE-C DATA

Carl G. Stehle Sep. 1980 144 p refs
(Grants NsG-5215; NsG-134-61)
(NASA-CR-163796; SR-467; PSU-IRL-SCI-467) Avail: NTIS HC A07/MF A01 CSCL 04A

An empirical model of the global atomic oxygen and helium distributions in the thermosphere is developed in a magnetic coordinate system and compared to similar models which are expanded in geographic coordinates. The advantage of using magnetic coordinates is that fewer terms are needed to make predictions which are nearly identical to those which would be obtained from a geographic model with longitudinal and universal time corrections. Magnetic coordinates are more directly related to the major energy inputs in the polar regions than geographic coordinates and are more convenient to use in studies of high latitude energy deposition processes. This is important for comparison with theoretical models where the number of coordinates is limited. The effect of magnetic activity on the atomic oxygen distribution in the morning sector of the high latitude thermosphere in the auroral zone is also considered. A magnetic activity indicator (ML) based on an auroral electrojet index (AL) and the 3 hour ap index are used to relate the atomic oxygen density variations to magnetic activity in this region. Author

N81-12685# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.

HEMISPHERIC ASYMMETRIES DETECTED FROM SATELLITE IONIZATION GAUGE MEASUREMENTS Interim Report

Joseph P. McIsaac 25 Feb. 1980 51 p refs
(Contract F19628-76-C-0190; AF Proj. 6690)
(AD-A090339; AFGL-TR-80-0066; AFGL-ERP-696) Avail: NTIS HC A04/MF A01 CSCL 04/1

Results obtained from the S3-1 ionization gauge measurements are statistically examined for hemispheric asymmetries in neutral density behavior. The parameter analysed in this study is the mean value R, the ratio of the measured density to the Jacchia 71 model value. Over 150,000 values obtained during the period from November 1974 to May 1975 and covering the altitude range from perigee (about 160 km) to 300 km are considered. Results are presented in the form of frequency histograms and graphs of mean ratios vs latitude. Significant hemispherical asymmetries are found and described in detail. GRA

N81-12686# Naval Ocean Systems Center, San Diego, Calif.

EFFECTS OF IONOSPHERIC REFLECTION HEIGHT AND GROUND CONDUCTIVITY ON EARTH-IONOSPHERE WAVEGUIDE MODE AND GROUND-WAVE ATTENUATION RATES Interim Report, Oct. 1979 - Apr. 1980

W. F. Moler and R. A. Pappert Jun. 1980 34 p refs
(DNA MIPR 80-563)
(AD-A090716; NOSC/TR-561) Avail: NTIS HC A03/MF A01 CSCL 20/14

A surviving ground-wave signal has previously been assumed to represent the minimum expected for vlf and lf systems operating in a severely disturbed environment. The authors show that for propagation over poorly conducting soil and under a depressed ionosphere, path losses may markedly exceed those predicted by the normal ground-wave attenuation rates. This is shown to be caused by the invasion of the ionosphere into the presupposed free-space region of the diffraction mode (ground-wave) 'dust.' Because of inherent uncertainties in the ground-wave model for some propagation conditions, the authors recommend that estimates of system performance in severe environments be based on Earth-ionosphere waveguide mode computational models. GRA

N81-12687# Lamont-Doherty Geological Observatory, Palisades, N. Y.

OBSERVATIONS OF POSITION, OCEAN DEPTHS, AND GRAVITY TAKEN FROM THE FRAM 2 AND CAMP 1 DRIFTING ICE STATIONS

B. Allen, J. Ardai, K. Hunkins, T. Lee, and T. O. Manley Sep. 1980 67 p refs
(Contract N00014-76-C-0004)
(AD-A090711; LDGO-CU-13-80; TR-13) Avail: NTIS HC A04/MF A01 CSCL 08/12

This report contains geophysical data collected by the Lamont group at the FRAM II and Camp I drifting stations. These data include station positions determined by satellite navigation, echo soundings, ice floe azimuths, magnetic declination and gravity readings. GRA

N81-12688# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

PARAMETERIZATION OF NET RADIATION AT THE SURFACE USING DATA FROM THE WANGARA EXPERIMENT M.S. Thesis

R. T. Edson 1980 99 p refs
(Contract DE-AS02-76EV-01340)
(DOE/EV-01340/T3) Avail: NTIS HC A05/MF A01

Hourly Wangara boundary layer data was used to substantiate previously derived empirical equations of the surface radiation budget. These equations only require measurements taken by a surface observer in order to be evaluated. A parameterization was made for infrared (IR) radiation. From this procedure, a residual radiation was obtained from the measured daytime net radiation data in order to approximate short wave (SW) radiation. Diurnal trends in radiation and other related meteorological parameters were also evaluated. For IR radiation, the Brunt equation was found to adequately represent effective radiation without clouds. IR attenuation (K-values) of 0.89, 0.64, and 0.51 were calculated for low, middle, and high clouds, respectively. A modification of Beer's Law was derived to evaluate the residual radiation under clear skies for SW radiation. With the surface albedo assumed at 0.15, a mean turbidity coefficient of 0.16 was determined. DOE

N81-12689# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

ROLE OF THE QINGHAI-XIZANG PLATEAU IN FEEDBACK MECHANISMS AFFECTING THE PLANETARY CIRCULATION

E. R. Reiter and D. Yi-Hui 1980 59 p refs
(Contract DE-AS02-76EV-01340)
(COO-1340-74) Avail: NTIS HC A04/MF A01

The Qinghai-Xizang plateau is of great importance in generating planetary long waves which, in resonance with similar waves induced by the Rocky Mountains, lead to the familiar pattern of quasi-stationary Rossby waves observed on monthly mean upper level pressure charts. Seasonal forcing of flow patterns also appears to be particularly strong in the Qinghai-

Xizang plateau region. The effects of the Qinghai-Xizang plateau on the interannual variability of the atmospheric circulation over Asia are but one important manifestation of a network of feedback mechanisms, ranging from the El Nino problems along the Peruvian coast to droughts in the Sahel region. The mechanisms involved were investigated. Results will lead to successful long range forecasting of weather phenomena. DOE

N81-12690# European Space Agency, Paris (France).
OPTICAL AND ATMOSPHERIC OPTICAL PARAMETERS DURING VISIBILITY TESTS IN THE NORTH OF GERMANY, 1977
Hans Eberhard Hoffmann May 1980 92 p refs Transl. into ENGLISH of "Opt. u. Vers. zur Sichtbarkeit in Norddeut. 1977", Rept. DFVLR-Mitt-79-06, Oberpfaffenhofen, West Germany Jun. 1979 Original report in GERMAN previously announced as X80-74382 Original German report available from DFVLR, Cologne DM 15
(ESA-TT-615; DFVLR-Mitt-79-06) Avail: NTIS HC A05/MF A01

Measurements of the inherent contrast of a 1.5 ton truck and a minesweeper were carried out using a photometer mounted in a helicopter. The results of the measurements are presented in diagrams and tables as a function of the background, the illumination of the target region, the angle of elevation, the time of day, the angle of azimuth, and the degree of cloud cover.
Author (ESA)

N81-12691# European Space Agency, Paris (France).
SOME RESULTS OF PRELIMINARY TESTS ON VALUES OF SKY-SEA CONTRAST (VISIBLE HORIZON) AS A FUNCTION OF ENVIRONMENTAL PARAMETERS
Hans Eberhard Hoffmann May 1980 22 p refs Transl. into ENGLISH of "Einige Ergebnisse von Vorversuchen zur Groesse des Kontrasts Himmel-Wasser (Horizont, Kimm) in Abhaengigkeit von Umgebungsparametern", Rept. DVFLR-FB-79-10, Oberpfaffenhofen, West Germany, Mar. 1979 Original report in GERMAN previously announced as X80-74381 Original German report available from DFVLR, Cologne DM 5,10
(ESA-TT-623; DFVLR-FB-79-10) Avail: NTIS HC A02/MF A01

During a series of tests determining the visibility of air and sea targets in the Baltic sea in autumn 1977, tests were conducted to determine the contrast between sky and sea as a function of various environmental parameters. Measurements of sky and sea light intensity were taken from a helicopter at heights of 15, 30, and 45 m. At a horizontal standard visibility of 10 km for example, the value for the contrast between sky and sea was found to be -0.14, and at a horizontal standard visibility of 19 km this value was -0.67. The angle between the direction of measurement and the sun's direction influenced the value of the contrast between sky and sea, as did the wind strength and thus the wave height. Author (ESA)

N81-12692# Atomic Weapons Research Establishment, Aldermaston (England).
THE 1976 EARTHQUAKE SEQUENCE IN UZBEKISTAN: FOCAL MECHANISMS DETERMINED USING THE RELATIVE AMPLITUDE METHOD
R. G. Pearce, Hilary Bainbridge, Pamela F. Key, and J. B. Young London Jul. 1980 174 p refs
(AWRE-O-27/80; BR74998) Avail: NTIS HC A08/MF A01; HMSO £4.50 PHI

The relative amplitude method of determining earthquake source orientations is applied to short period teleseismic array observations of the 1976 Uzbekistan earthquake sequence. Many of these events are shown to be consistent with a double couple source, and the method provides well determined orientations for most events with magnitude between 4.0 and 5.6.
Author (ESA)

N81-12693# Royal Aircraft Establishment, Farnborough (England).
FEATURES OF THE UPPER ATMOSPHERE REVEALED BY ANALYSIS OF THE ORBIT OF COSMOS 1009 ROCKET, 1978-50B
H. Hiller and D. G. King-Hele London HMSO Apr. 1980 29 p refs
(RAE-TR-80052; RAE-SPACE-579; BR74910) Avail: NTIS HC A03/MF A01

The orbit of Cosmos 1009 was analyzed during the final 14 days of its life using the computer program PROP6 and 1100 observations. Atmosphere features at heights between 125 and 175 km were studied. From the decrease in perigee height, five values of density scale height, accurate to plus or minus 4% were obtained. Analysis of the perigee position during the last four days show that the ellipticity of the upper atmosphere is approximately equal to that of the earth for the first two days, and about half in the last two. Zonal winds at a height of 150 to 160 km at latitude near 47 deg north were found to be very weak. Author (ESA)

N81-12694# National Technical Information Service, Springfield, Va.
ATMOSPHERIC ECHO SOUNDING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1980
Audrey S. Hundemann Sep. 1980 106 p Supersedes NTIS/PS-79/0989; NTIS/PS-78/0916
(PB80-815004; NTIS/PS-79/0989; NTIS/PS-78/0916) Avail: NTIS HC $30.00/MF $30.00 CSCL 04A

Abstracts pertaining to equipment, design, and use of acoustic sounders are presented. Use of the sounders to sense the atmosphere for weather changes, temperature inversions, aircraft wakes, ionospheric properties, and other characteristics is discussed. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-12695 British Library Lending Div., Boston Spa (England). Meteorological Office.
THE STRUCTURE OF AIR TEMPERATURE FLUCTUATIONS IN THE NORTHERN HEMISPHERE, PART 2.
Ye. S. Rubinshteyn [1980] 20 p refs Transl. into ENGLISH of the book "Leningrad", Gidrometeorizdat, 1977
(BLL-Trans-1434-(9022.549)-Pt-2) HC A02/MF A01

The inherent difficulties in investigating the causes of climatic change are bound up with the fact that a number of cosmic and geophysical factors give rise in the global atmosphere to a number of quasiperiodic processes which lead to cyclic fluctuations of temperature with various wavelengths, phases and amplitudes. The role of one such factor in affecting the temperature of the air in the northern hemisphere, namely the atmosphere circulation, was examined. Author

N81-12696 Institut d'Aeronomie Spatiale de Belgique, Brussels.
DERIVATION OF ZERO-DIMENSIONAL FROM ONE-DIMENSIONAL CLIMATE MODELS
C. Nicolis 1979 23 p refs Submitted for publication
(Aeronomica-Acta-A-208-1979) Avail: Issuing Activity

A one dimensional energy balance equation, involving diffusive energy transport and taking into account the ice albedo feedback, is considered. A systematic elimination of the spatial degrees of freedom is performed. This gives rise to a zero dimensional climate model displaying the explicit dependence of planetary albedo on planetary temperature. In the general case, the zero dimensional model involves memory effects as well as two characteristic relaxation rates. Author (ESA)

N81-12697*# Raytheon Co., Wayland, Mass. Electro-Optics Systems Lab.
DEVELOPMENT OF CO2 LASER DOPPLER INSTRUMENTATION FOR DETECTION OF CLEAR AIR TURBULENCE, VOLUME 1 Final Report, 10 Feb. 1972 - 27 Dec. 1978
C. E. Harris and A. V. Jelalian Sep. 1979 268 p refs 2 Vol.
(Contract NAS8-28424)
(NASA-CR-161611; ER78-4392-1) Avail: NTIS HC A12/MF A01 CSCL 04B

Modification, construction, test and operation of an advanced airborne carbon dioxide laser Doppler system for detecting clear air turbulence are described. The second generation CAT program

and those auxiliary activities required to support and verify such a first-of-a-kind system are detailed: aircraft interface; ground and flight verification tests; data analysis; and laboratory examinations. S.F.

N81-12698*# Raytheon Co., Wayland, Mass.
DEVELOPMENT OF CO2 LASER DOPPLER INSTRUMENTATION FOR DETECTION OF CLEAR AIR TURBULENCE, VOLUME 2: APPENDICES Final Report, 10 Feb. 1972 - 27 Dec. 1978
C. E. Harris and A. V. Jelalian Sep. 1979 222 p refs 2 Vol.
(Contract NAS8-28424)
(NASA-CR-161610; ER78-4392-2) Avail: NTIS HC A11/MF A01 CSCL 04B

Analyses of the mounting and mount support systems of the clear air turbulence transmitters verify that satisfactory shock and vibration isolation are attained. The mount support structure conforms to flight crash safety requirements with high margins of safety. Restraint cables reinforce the mounts in the critical loaded forward direction limiting maximum forward system deflection to 1 1/4 inches. S.F.

N81-12699# Naval Research Lab., Washington, D. C.
A SIMULATION STUDY ON THE IMPACT OF SATELLITE SENSED WINDS ON TROPICAL CYCLONE FORECAST
Simon Wei Chang and Rangarao V. Madala 3 Oct. 1980 49 p refs
(AD-A090322; NRL-MR-4340) Avail: NTIS HC A03/MF A01 CSCL 04/2

The impact of the satellite-sensed winds on the intensity forecasts of tropical cyclones is evaluated by a simulation study with an axisymmetric numerical model. The parameterized physics in the forecast model are deliberately made different from those in the model that generates the observation. The initial wind errors for the forecasts are systematic assumed to be caused entirely by the non-divergent, static initialization. Model generated observations are assimilated into forecasts by a 12h dynamic initialization. GRA

N81-12700# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE USE OF THE FINITE ELEMENT METHOD IN METEOROLOGICAL MODELLING Ph.D. Thesis - Oklahoma Univ.
John Dutton Warburton Dec. 1979 130 p refs
(Grant NSF ATM-77-23111)
(AD-A090761; AFIT-79-247D) Avail: NTIS HC A07/MF A01 CSCL 04/2

The finite element method may relieve some of the problems associated with numerical modelling of the atmosphere. The method reduces the problem of nonlinear computational instability, allows arbitrary placement of grid points, and offers greater flexibility in the handling of boundary conditions. In addition, the finite element method has been shown to be more accurate for some types of problems. This research concentrates on the ability of the finite element method to serve as the means of solving the equations which describe flow in the atmosphere and provides answers as to the type of finite element approximation best suited for meteorological research. Five different finite elements using both linear and quadratic interpolation are tested in the space domain. Several time differencing schemes are also tested with the elements in order to determine the most accurate and efficient configuration. In addition, the concepts of lumped and consistent mass are examined and tested as well as alternative methods of handling the computer implementation of the method. GRA

N81-12701# Aeronautical Research Associates of Princeton, Inc., N. J.
THE 1980 STATUS REPORT ON LOW-LEVEL, ATMOSPHERIC TURBULENCE MODEL FOR MARINE ENVIRONMENTS Final Report, 25 Jun. 1979 - 25 Jun. 1980
W. S. Lewellwn, D. A. Oliver, R. D. Sullivan, and G. Sandri Jul. 1980 125 p refs
(Contract N00019-79-C-0366)
(AD-A090576; ARAP-420) Avail: NTIS HC A06/MF A01 CSCL 04/2

This report details the most recent developments to ARAP's program for computing the detailed low-level atmospheric distribution of velocity, temperature, moisture, refractive index, and the turbulent variances of these quantities. Model modifications discussed include the incorporation of an anisotropic length scale and the investigation into the continuation of a simpler integral model. Model calculations show the improved predictions of horizontal turbulent variances made possible by the anisotropic scale formulation, and provide for comparisons with the results of NEPRF's model calculations. GRA

N81-12702# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
FURTHER STUDY OF THE VARIABILITY IN THE FREQUENCY OF TYPHOON FORMATION OVER THE WEST PACIFIC OCEAN
Yi-Hui Ding and Elmar R. Reiter 1980 84 p refs
(Contract DE-AS02-76EV-01340)
(COO-1340-75) Avail: NTIS HC A05/MF A01

The variability in the frequency of typhoon formation over the West Pacific ocean is examined, emphasizing the effects of the large-scale sea-air system on the activity of typhoons. Some important relationships between typhoon formation and the climatological aspect of air-sea interaction are pointed out. DOE

N81-12703# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
VARIABILITY WITHIN THE OCEAN-ATMOSPHERIC SYSTEM OVER THE NORTH PACIFIC M.S. Thesis
Paul E. Ciesielski 1980 154 p refs
(Contract DE-AS02-76EV-01340; Grant NSF ATM-78-17835)
(DOE/EV-01340/T1) Avail: NTIS HC A08/MF A01

Characteristics of the oceanic mixed layer over the North Pacific were examined utilizing a number of statistical methods. Based on the analyses of twelve years of data, a quasi-meridional differentiation in sea surface temperature (SST) spectra across the North Pacific was observed. The SST spectra became increasingly red as an increasing function of latitude. A strong 21 to 26 day cycle in SST anomalies is discussed which may be a reflection of heat fluxes. These fluxes also vacillate significantly on this time-scale in conjunction with cycles observed in the atmospheric energy modes of available potential and kinetic energy. Examination of an oceanic heat budget on a spatial and temporal basis suggests that the impact of latent and sensible heat fluxes upon SST is partially a function of the magnitude of the heat fluxes as well as of the depth to which their effects are mixed. DOE

N81-12704# Battelle Pacific Northwest Labs., Richland, Wash.
DOE CANDIDATE SITE METEOROLOGICAL MEASUREMENT PROGRAM
D. S. Renne and W. F. Sandusky Jan. 1980 10 p Presented at the IEA Expert Meeting, Boone, N. C., 26-28 Sep. 1979
(Contracts DE-AC06-76RL-01830; EY-76-C-06-1830)
(PNL-SA-7840; CONF-7909167-1) Avail: NTIS HC A02/MF A01

In March 1976, DOE issued an RFP to acquire, on a competitive basis, a group of candidate sites, proposed by utilities interested in the field testing program. A total of 17 candidate sites was selected from the 64 proposals submitted in response to the RFT. From these sites, five were chosen thus far to receive turbines for field testing. The meteorological measurement activities at these sites and details of the measurement program as it exists in late 1979 are decreased. In addition, the directions this program will take in the near future, and the options interested electric service organizations have for participating in the program are discussed. DOE

N81-12705# Argonne National Lab., Ill.
AN ASSESSMENT OF THE ATMOSPHERIC EFFECTS OF A SATELLITE POWER SYSTEM
D. M. Rote, K. L. Brubaker, J. Lee, and A. R. Valentino 1979 30 p refs Presented at the 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami, Fla., 10-13 Dec. 1979
(Contract W-31-109-eng-38)
(CONF-791204-39) Avail: NTIS HC A03/MF A01

One aspect of the program, the Atmospheric Effects Assessment is detailed. Starting with the troposphere, potential atmospheric effects and present understanding of them are summarized as a function of altitude. The main source of

disturbance is described as the space transportation system, which would include a heavy lift launch vehicle (HLLV) approximately five times larger than the Saturn V rocket. To transport the necessary materials into space, HLLVs must be launched once or twice per day for thirty years. Essentially all levels of the atmosphere will be effected. However, as the altitude increases, the atmosphere becomes increasingly rarified, the possible degree of modification increases, and the state of knowledge regarding such modifications decreases. E.D.K.

N81-12706# Royal Netherlands Meteorological Inst., The Hague. Meteorologisch Onderzoek.

A SET OF COMPUTER PROGRAMS TO PROCESS TURBULENCE DATA MEASURED AT THE 200 m MAST AT CABAUW, NETHERLANDS

A. G. M. Driedonks, P. A. T. Neiuwendijk, and C. J. Goes 1980 95 p refs

(KNMI-WR-80-3) Avail: NTIS HC A05/MF A01

Simultaneous measurements are made of three wind components, dry bulb temperature, wet bulb temperature at 20, 40, 80, 120, 160, and 200 m. Standard sampling rate is 5 Hz. Registration of the turbulence data is performed by a Hewlett Packard 21 MX minicomputer, which formats the data on magnetic tape. Documented FORTRAN programs were written for a Burroughs B6700 computer for error checking and calibration, for providing averages over any time interval and plotting. It is also possible to calculate variances and covariances over any chosen time interval between variables at each level. Spectral distribution of the variances and covariances can be calculated. Program listings are given. Author (ESA)

N81-12707# World Meteorological Organization, Geneva (Switzerland).

METEOROLOGICAL FACTORS AFFECTING THE EPIDEMIOLOGY OF THE COTTON LEAF WORM AND THE PINK BOLLWORM

M. H. Omar 1980 58 p refs

(WMO-532; TN-167; ISBN-92-63-10532-4) Avail: NTIS HC A04/MF A01

The geographical distribution, life cycle and damage and control are discussed for each insect. Effects of meteorological factors on biological processes are presented, including relative humidity, soil moisture and wind. Light trap studies for the cotton leaf worm are described. For the pink bollworm, effects of aqueous submersion, soil temperature and photoperiod are given. Recommendations are presented for improving the meteorological contributions towards understanding the epidemiology and facilitating control of both pests. Author (ESA)

N81-12708# World Meteorological Organization, Geneva (Switzerland).

REPORT OF THE FIRST SESSION OF THE JOINT SCIENTIFIC COMMITTEE FOR THE WORLD CLIMATE RESEARCH PROGRAM AND THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM

1980 142 p Presented at Amsterdam, 26 Mar.-3 Apr. 1980 Prepared in cooperation with International Council of Scientific Unions, Rome

Avail: NTIS HC A07/MF A01

Activities concerning scientific programs are presented, with decisions and recommendations. Included are reports on the Global Weather Experiment, the tropical, monsoon, mountain, radiation and air-surface subprograms, on the World Climate Program, and on the World Climate Research Program are included. The report of the working group on numerical experimentation and the report of the fourth meeting of the Joint Organizing Committee Board for the climate dynamics subprogram are appended. Author (ESA)

N81-12709# World Meteorological Organization, Geneva (Switzerland). International MONEX Management Centre (Winter).

FIRST GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP) GLOBAL EXPERIMENT OPERATIONS REPORT SERIES. VOLUME 7: WINTER MONEX FIELD PHASE REPORT Global Atmospheric Research Programme

Apr. 1980 189 p refs Prepared in cooperation with International Council of Scientific Unions, Rome

Avail: NTIS HC A09/MF A01

Synoptic features of the Winter Monsoon Experiment from Dec. 78 to Mar. 79 are presented. Cold surge, ridge and trough positions, middle tropospheric trough, cross equatorial flow, near equatorial disturbances, and diurnal variations in convective activity are discussed. A weather summary for Dec. 1978 is also given. Author (ESA)

N81-12710# World Meteorological Organization, Geneva (Switzerland).

THE GLOBAL WEATHER EXPERIMENT. FIRST GLOBAL ATMOSPHERIC RESEARCH PROGRAMME (GARP) GLOBAL EXPERIMENT OPERATIONS REPORT SERIES. VOLUME 9: RESULTS OF SUMMER MONEX FIELD PHASE RESEARCH, PART A Global Atmospheric Research Programme

R. L. Grossman, ed. Jun. 1980 247 p refs Prepared in cooperation with International Council of Scientific Unions, Rome

Avail: NTIS HC A11/MF A01

The field research program used available Level 2A meteorological data to monitor the quality and completeness of data from all observing systems and the development of the weather situation and special meteorological events. Some 25 papers present large scale aspects of the summer monsoon, the onset phase of the monsoon, Arabian Sea and Bay of Bengal studies, mesoscale studies of monsoon disturbances, and boundary layer studies. Author (ESA)

N81-12711# Societe Francaise d'Etudes et de Realisations d'Equipments Aeronautiques (Sofreavia), Paris (France).

STUDY OF THE OPERATIONAL DEPLOYMENT OF SIRIO-2 GROUND STATIONS. VOLUME 1 [ETUDE DU DEPLOIEMENT OPERATIONNEL DES STATIONS-SOL SIRIO-2. TOME 1]

Paris ESA Feb. 1980 76 p In FRENCH 3 Vol.

(Contract ESA-4141/79-F-FC(SC))

(ESA-CR(P)-1369-Vol-1) Avail: NTIS HC A05/MF A01

The meteorological data traffic in the regions of Africa and Middle East covered by the experimental satellite SIRIO-2 is studied. The exchanges between the national meteorological centers, the regional telecommunication centers, and the principal circuit of the World Weather Watch (WWW) are analyzed both for alphanumeric and image data. The potential traffic is evaluated starting from the WWW program and the needs formulated by the concerned states. Particular attention is devoted to the data traffic required by the world meteorological community for numerical weather forecasting. Author (ESA)

N81-12712# Societe Francaise d'Etudes et de Realisations d'Equipments Aeronautiques (Sofreavia), Paris (France).

STUDY OF THE OPERATIONAL DEPLOYMENT OF SIRIO-2 GROUND STATIONS. VOLUME 2 [ETUDE DU DEPLOIEMENT INDUSTRIEL DES STATIONS-SOL SIRIO-2. PART 2]

Paris ESA Feb. 1980 67 p refs In FRENCH 3 Vol.

(Contract ESA-4141/79-F-FC(SC))

(ESA-CR(P)-1369-Vol-2) Avail: NTIS HC A04/MF A01

The organization of the meteorological communication network in Africa and the technical characteristics of the ground stations are studied. A two level organization of the network is proposed. The data acquisition, and data processing by the ground stations are defined in detail for each type of station. The constraints imposed by the African environment are discussed. Author (ESA)

N81-12713# Societe Francaise d'Etudes et de Realisations d'Equipments Aeronautiques (Sofreavia), Paris (France).

STUDY OF THE OPERATIONAL DEPLOYMENT OF SIRIO-2 GROUND STATIONS, VOLUME 3 [ETUDE DU DEPLOIEMENT OPERATIONNEL DES STATIONS-SOL SIRIO-2, TROISIEME PARTIE]

Paris ESA Feb. 1980 58 p refs In FRENCH 3 Vol.

(ESA-CR(P)-1369-Vol-3) Avail: NTIS HC A04/MF A01

An experimental meteorological satellite data handling project is proposed. Its goal is to compensate deficiencies of the Meteorological Data Distribution project of the World Weather Watch by means of experimental Sirio satellite data. The ground

stations for the proposed network are described including a list of equipment. The installation, operation, management, and budget of the system are discussed. Continuation of the project activities is analyzed in terms of extension of the Sirio-2 satellite program or by adaptation to Meteosat data utilization. Author (ESA)

N81-12714# World Meteorological Organization, Geneva (Switzerland).
MANUAL ON THE GLOBAL DATA PROCESSING SYSTEM. VOLUME 2: REGIONAL ASPECTS
1980 62 p
(WMO-485-Vol-2) Avail: NTIS HC A04/MF A01

For each World Meteorological Organization region, minimum standards for quality control of real time meteorological data, the observational data requirements and times of receipt, scales and projections of meteorological charts and transmission priorities are given (referenced largely to volume 1). Responsibilities for data storage, standards for quality control, classification and cataloging procedures, and media and formats for data exchange are defined for non-real time data processing. Instructions for monitoring of the Global Data Processing system are listed. Author (ESA)

N81-12715# National Technical Information Service, Springfield, Va.
FOG PREDICTION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jun. 1980
Guy E. Habercom, Jr. Aug. 1980 184 p Supersedes NTIS/PS-79/0820 and NTIS/PS-78/0775
(PB80-813959; NTIS/PS-79/0820; NTIS/PS-78/0775) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Methods for predicting the possibility of fog formation and forecasting the eventual natural dissipation of fog are investigated. Worldwide climatic conditions conducive to the probability of fog in specific geographic areas are observed. This updated bibliography contains 179 citations, 10 of which are new entries to the previous edition. GRA

N81-12716# National Technical Information Service, Springfield, Va.
CLEAR AIR TURBULENCE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Guy E. Habercom, Jr. Aug. 1980 305 p Supersedes NTIS/PS-79/0972; NTIS/PS-78/0938
(PB80-814825; NTIS/PS-79/0972; NTIS/PS-78/0938) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

Clear air turbulence and its relationship to air transportation is documented in the cited research reports. Its meteorological occurrences, its detection, and aircraft encounters with the phenomena are investigated. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-12717*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DYNAMICS OF OCEANIC FRONTS. PART 1: THE GULF STREAM
Timothy W. Kao Aug. 1970 31 p refs
(NASA-TM-80335-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 08C

The establishment and maintenance of the mean hydrographic properties of large scale density fronts in the upper ocean is considered. The dynamics is studied by posing an initial value problem starting with a near surface discharge of buoyant water with a prescribed density deficit into an ambient stationary fluid of uniform density. The full time dependent diffusion and Navier-Stokes equations for a constant Coriolis parameter are used in this study. Scaling analysis reveals three independent length scales of the problem, namely a radius of deformation or inertial length scale, Lo, a buoyance length scale, ho, and a diffusive length scale, hv. Two basic dimensionless parameters are then formed from these length scales, the thermal (or more precisely, the densimetric) Rossby number, Ro = Lo/ho and the Ekman number, E = hv/ho. The governing equations are then suitably scaled and the resulting normalized equations are shown to depend on E alone for problems of oceanic interest. Under this scaling, the solutions are similar for all Ro. It is also shown that 1/Ro is a measure of the frontal slope. The governing equations are solved numerically and the scaling analysis is confirmed. The solution indicates that an equilibrium state is established. The front can then be rendered stationary by a barotropic current from a larger scale along-front pressure gradient. In that quasisteady state, and for small values of E, the main thermocline and the inclined isopycnics forming the front have evolved, together with the along-front jet. Conservation of potential vorticity is also obtained in the light water pool. The surface jet exhibits anticyclonic shear in the light water pool and cyclonic shear across the front. Author

N81-12718# National Technical Information Service, Springfield, Va.
THE GULF STREAM. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Audrey S. Hundemann Aug. 1980 212 p Supersedes NTIS/PS-79/0903; NTIS/PS-78/0844
(PB80-814098; NTIS/PS-79/0903; NTIS/PS-78/0844) Avail: NTIS HC $30.00/MF $30.00 CSCL 08C

Abstracts dealing primarily with the Gulf Stream's currents, salinity, temperature and transport properties are presented. A few abstracts pertain to oceanographic equipment used in the studies. Remote sensing studies are included. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-12719*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GENESIS OF BREATH SOUNDS-PRELIMINARY VERIFICATION OF THEORY
John L. Patterson (Medical Coll. of Virginia, Richmond), Jay C. Hardin, and John M. Seiner Oct. 1980 18 p refs Presented at the 5th Intern. Lung Sounds Conf., London, 15-16 Sep. 1980
(NASA-TM-81897) Avail: NTIS HC A02/MF A01 CSCL 06P

Experimental results are presented which tend to validate a previously developed theory of sound production in the human lung over a particular Reynolds number range. In addition, a new, presently nonunderstood, phenomenon was observed at higher Reynolds number. These results, which show how sound generation in the lung depends upon the physiologically important variables of volume flow rate and bronchial diameter, have potentially important application in noninvasive lung examination and the diagnosis of lung disease. Author

N81-12720# Army Mobility Equipment Command, Fort Belvoir, Va.
EFFECTS OF LOW POWER MICROWAVES ON THE LOCAL CEREBRAL BLOOD FLOW OF CONSCIOUS RATS
Kenneth J. Oscar Jun. 1980 10 p refs
(AD-A090426) Avail: NTIS HC A02/MF A01 CSCL 06/18

A decoy and deception concept presently being considered is to remotely create the perception of noise in the heads of personnel by exposing them to low power, pulsed microwaves. When people are illuminated with properly modulated low power microwaves the sensation is reported as a buzzing, clicking, or hissing which seems to originate (regardless of the person's position in the field) within or just behind the head. The phenomena occurs at average power densities as low as microwatts per square centimeter with carrier frequencies from 0.4 to 3.0 GHz. By proper choice of pulse characteristics, intelligible speech may be created. Before this technique may be extended and used for military applications, an understanding of the basic principles must be developed. Such an understanding is not only required to optimize the use of the concept for camouflage, decoy and deception operations but is required to properly assess safety factors of such microwave exposure. GRA

N81-12721# Duke Univ., Durham, N. C. Dept. of Biochemistry.
MECHANISMS OF RECOMBINATION AND FUNCTION OF DNA IN BACTERIA Progress Report, 16 Aug. 1979 - 15 Aug. 1980
W. R. Guild 1980 5 p refs
(Contract DE-AS05-76EV-03941)
(DOE/EV-03941/52) Avail: NTIS HC A02/MF A01

The process of plasmid transformation in pneumococcus was analyzed. Other efforts included the continued study of resistance determinants inserted in the chromosomes of clinical strains of pneumococcus and their transfer by conjugation, a novel phenomenon, discovered last year, and temperate phages of pneumococcus. DOE

N81-12722# Brookhaven National Lab., Upton, N. Y. Dept. of Biology.
SYNCHROTRON RADIATION SOURCES FOR PHOTOBIOLOGY AND ULTRAVIOLET, VISIBLE AND INFRARED SPECTROSCOPY
J. C. Sutherland 1980 9 p refs Presented at the 8th Intern. Congr. on Photo-Biology Strasbourg, France, 20-25 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28149; CONF-800762-1) Avail: NTIS HC A02/MF A01

The advantages of synchrotron radiation in several types of spectroscopy, microscopy and diffraction studies were examined. The availability of synchrotron radiation will expand rapidly in the early 1980's as experimental programs start at the new generation of dedicated storage rings. Sources for synchrontron radiation are discussed. DOE

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-12723* National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 211, OCTOBER 1980
Oct. 1980 76 p
(NASA-SP-7011(211)) Avail: NTIS HC $7.00 CSCL 06E

This bibliography lists 212 reports, articles, and other documents introduced into the NASA scientific and technical information system in September 1980. Author

N81-12724*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTIC TOOTH CLEANER Patent Application
Joseph S. Heyman, inventor (to NASA) Filed 14 Aug. 1980 13 p
(NASA-Case-LAR-12471-1; US-Patent-Appl-SN-178193) Avail: NTIS HC A02/MF A01 CSCL 06B

An acoustic oral hygiene unit that uses acoustic energy to oscillate mild abrasive particles in a water suspension which is then directed in a low pressure stream onto the teeth is described. The oscillating abrasives scrub the teeth clean removing food particles, plaque, calculous, and other foreign material from tooth surfaces, interproximal areas, and tooth gingiva interface more effectively than any previous technique. The relatively low power output and the basic design make the invention safe and convenient for everyday use in the home without special training. This invention replaces all former means of home dental prophylaxis, and requires no augmentation to fulfill all requirements for daily oral hygienic care. NASA

N81-12725*# Wisconsin Univ., Madison. Biomedical Applications Team.
DEFINITION OF PROBLEMS OF PERSONS IN SHELTERED CARE ENVIRONMENTS Project Extension Report, Jan. - Dec. 1978
W. N. Fetzner 15 Jan. 1979 56 p refs
(Contract NAS5-23500)
(NASA-CR-160050) Avail: NTIS HC A04/MF A01 CSCL 06E

Innovations in health care using aerospace technologies are described. Voice synthesizer and voice recognition technologies were used in developing voice controlled wheel chairs and optacons. Telephone interface modules are also described. T.M.

N81-12726# Boeing Aerospace Co., Seattle, Wash. Data Processing Technology.
PERIPHERAL CUES AND COLOR IN VISUAL SIMULATION Final Report, Dec. 1978 - Mar. 1980
Conrad L. Kraft, Charles D. Anderson, and Charles L. Elworth Mar. 1980 166 p refs
(Contract F49620-79-C-0030; AF Proj. 2313)
(AD-A089837; D180-25945-1; AFOSR-80-0873TR) Avail: NTIS HC A08/MF A01 CSCL 06/16

In the future, combat readiness must depend on flight crew training with simulators to train a sufficient number of pilots and maintain a high degree of readiness. With simulators this may be done without consuming large amounts of fuel and speeding up the aging of very expensive aircraft. On the surface this sounds like an easy solution. It becomes expensive when one sees the complexity of the simulators and their visual systems. The real danger does not lie in costs however, but in the possibility that the validity of the training and its transfer to flight performance may not reach the assumed levels. The Viet Nam situation pointed out the high probability of loss of a pilot in the first ten hours of his combat flying. The solution is to conduct the proper amount of research to economically establish: (a) the reliability, validity and transfer of training from simulation to operational combat flying; (b) the essential content of the external visual scenes required for such training; (c) the quantity and type of motion cues that are essential for each combat task; (d) the cue coordination that facilitates simulator training and transfer of such training and (e) what quantity of initial recurrent and specific aircraft training is necessary to maintain combat readiness. GRA

N81-12727# Walter Reed Army Inst. of Research, Washington, D.C.
RAPID TRANSMERIDIAN DEPLOYMENT: COGNITIVE PERFORMANCE AND CHRONOBIOLOGIC PROPHYLAXIS FOR CIRCADIAN DYSCHRONISM
R. Curtis Graeber, Bruce N. Cuthbert, Helen C. Sing, Robert J. Schneider, and G. Rufus Sessions Jun. 1980 15 p refs
(AD-A090393) Avail: NTIS HC A02/MF A01 CSCL 06/19

Rapid deployment of combat units to overseas locations is a primary concern of today's strategic planners. Such movements require the airlifting of units across multiple time zones. Numerous studies have documented the adverse physiological and behavioral consequences accompanying the rapid crossing of three or more time zones. These effects result from the requirement that the body must adjust its circadian rhythms to the new local time. Under normal conditions, these daily cycles are synchronized by the external Zeitgebers (i.e., time-givers) of the local environment. The sudden shifting of these Zeitgebers causes the shifting at different rates of the body's physiological, biochemical, and behavioral rhythms. While some circadian rhythms adjust quite rapidly, others adjust very slowly. Consequently, the passenger's circadian system is not only out of synchrony with the environment but is also internally desynchronized. It is the latter condition, circadian dyschronism, which is particularly responsible for the fatigue and malaise typically reported as 'jet lag' during the first several days following rapid transmeridian flight. GRA

N81-12728# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
PARAMETER IDENTIFICATION TECHNIQUES FOR PHYSIOLOGICAL CONTROL SYSTEMS Interim Report
H. T. Banks Jul. 1980 48 p refs
(Contract DAAG29-79-C-0161; Grants AF-AFOSR-3092-76; NSF MCS-79-05774; AF Proj. 2304)
(AD-A090547; AFOSR-80-1001TR) Avail: NTIS HC A03/MF A01 CSCL 06/16

Parameter identification techniques for problems involving functional and partial differential equation models are discussed. The methods presented combine standard ordinary differential equation algorithms with Ritz-Galerkin ideas in reducing problems

for infinite dimensional state systems to finite dimensional state problems. GRA

N81-12729# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

XDC-2 DIGITAL DECOMPRESSION COMPUTER: ASSESSMENT OF DECOMPRESSION PROFILES BY ULTRASONIC MONITORING, PHASE 1, 36-54 MSW

R. Y. Nishi, K. E. Kisman, I. P. Buckingham, B. C. Eatock, and G. Masurel Jul. 1980 49 p refs
(AD-A090467; DCIEM-80-R-32) Avail: NTIS HC A03/MF A01 CSCL 06/11

Decompression from experimental, operational, and training dives at the Defence and Civil Institute of Environmental Medicine (DCIEM) has been carried out for many years under control of decompression computers rather than by means of published decompression tables. The XDC-2 digital decompression computer and dive monitor is presently in use at DCIEM. An evaluation program for determining and defining the operational limiting bottom times for different depths and the safety of using the computer by following exactly the displayed safe ascent during decompression has been started. In this report, the results of Phase I of the evaluation program, covering the depth range 36 to 54 meters of seawater (msw), are presented. Seventeen chamber dives, consisting of 102 man-dives, were conducted using 9 different profiles. In order to assist in the evaluation of the XDC-2 profiles, two Doppler ultrasonic bubble detectors were used to monitor bubbles in the diving subjects for at least 3 hours and, in some cases, up to 7 hours after the start of decompression. GRA

N81-12730# Army Aeromedical Research Lab., Fort Rucker, Ala. Field Research and Biomedical Applications Div.

EVALUATION OF ARMY AVIATOR HUMAN FACTORS, FATIGUE, IN A HIGH THREAT ENVIRONMENT Final Report

Chester E. Duncan, Michael G. Sanders, and Kent A. Kimball Sep. 1980 70 p refs
(DA Proj. 3E1-62773-A-819)
(AD-A090751; USAARL-80-8) Avail: NTIS HC A04/MF A01 CSCL 01/2

Questionnaire data received from student and instructor pilots indicate significant levels of fatigue when flying in different flight altitudes and profiles; the lower the altitude flown, the more rapidly pilots experience fatigue. These data suggest night standard flight is 1.4 times as fatiguing as day standard flight; day terrain flight is 1.3 times as fatiguing as day standard flight; and night terrain flight, the most difficult flight profile examined, is 1.97 times as fatiguing as day standard flight. Army Regulation 95-1, 1 January 1980, sets a maximum of 140 hours per month per aviator of day flight in a combat environment. Existing doctrine emphasizes nap-of-the-Earth techniques, and if so accomplished for 140 hours could possibly result in an unsafe and severely fatigued helicopter pilot. Field commanders utilizing the guidelines presented in this report may organize and more effectively continue their mission in Army aviation. GRA

N81-12731# Vanderbilt Univ., Nashville, Tenn. Biomedical Computing Technology Information Center.

CAMIRD 3: COMPUTER ASSISTED MEDICAL INTERNAL RADIATION DOSIMETRY, FORTRAN IV VERSION

C. Riccardo Bellina and Riccardo Guzzardi 1980 113 p refs Prepared in cooperation with CNR, Pisa, Italy
(Contract DE-AS05-80EV-10343)
(DOE/EV-10303/5) Avail: NTIS HC A06/MF A01

The FORTRAN IV version of the CAMIRD/II Package (1) revised is described. In addition another FORTRAN IV program named TILDY (2), which determines the cumulated activity, was revised and modified to be used as a subroutine of CAMIRD's main program. With such an organization all the calculation involved in dose computation becomes easier and quicker. DOE

N81-12732# Rochester Univ., N. Y. Dept. of Radiation Biology Biophysics.

EFFECT OF IONIZING RADIATIONS ON CONNECTIVE TISSUE

K. I. Altman and G. B. Gerber 1980 137 p Prepared in cooperation with Centre d'Etude de l'Energie Nucleaire, Mol, Belgium
(Contracts DE-AC02-76EV-03490; B232-76-1B108)
(UR-3490-1900) Avail: NTIS HC A07/MF A01

The effects of ionizing radiations on connective tissue in lung, heart, vasculature, kidney, skin, and skeletal tissues are reviewed. Special emphasis is given to the effect of ionizing radiations on vasculo connective tissue and fibrotic changes following radiation induced injury to organs and tissues. The general biochemistry physiology, and pathology of connective tissue is reviewed together with the participation of connective tissue in disease. DOE

N81-12733# Battelle Pacific Northwest Labs., Richland, Wash.

EVALUATION OF SEVERAL METHODS FOR ASSESSING THE EFFECTS OF OCCUPATIONAL EXPOSURE TO RADIATION

Ethel S. Gilbert May 1980 28 p refs Presented at the Amer. Statist. Soc. Meeting, Houston, Tex., 11-14 Aug. 1980
(Contract DE-AC06-76RL-01830)
(PNL-SA-8438; CONF-800820-1) Avail: NTIS HC A03/MF A01

Several methods of analysis are presented and evaluated. Questions of interest include whether or not to utilize an external control, and how to handle the highly skewed exposure data most effectively. Expressions for the power of various procedures are used not only to compare methods but also to evaluate the potential for detecting effects in occupationally exposed populations. DOE

N81-12734# Royal Aircraft Establishment, Farnborough (England).

SOME FURTHER THOUGHTS ON TEMPORARY THRESHOLD SHIFT

K. R. Maslen London HMSO Jun. 1980 11 p refs
(RAE-TM-FS-338; BR75056) Avail: NTIS HC A02/MF A01

Data on threshold shift of hearing in an individual due to intermittent noise exposure were compared with pressure theory for continuous exposure. The ultimate shifts due to alternating exposure to equal short periods of one kind of noise at different levels are calculated and presented graphically. The probable errors due to lapse of time between the cessation of the noise exposure and measurement of the threshold are discussed, and it is suggested that such errors are well within probable experimental errors. Author (ESA)

N81-12735# National Technical Information Service, Springfield, Va.

HYPERBARIC OXYGENATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980

Elizabeth A. Harrison Aug. 1980 165 p Supersedes NTIS/PS-79/0744; NTIS/PS-78/0676
(PB80-813769; NTIS/PS-79/0744; NTIS/PS-78/0676) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

Microbiology, respiratory infections, oxygen toxicity, diving, decompression sickness and metabolism as applied to hyperbaric oxygenation are covered in approximately 160 citations. GRA

N81-12736# National Technical Information Service, Springfield, Va.

ANTHROPOMETRY: BASIC STUDIES AND APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1976 - Jul. 1980

Edith Kenton Aug. 1980 143 p Supersedes NTIS/PS-79/0935; NTIS/PS-78/0866
(PB80-813645; NTIS/PS-79/0935; NTIS/PS-78/0866) Avail: NTIS HC $30.00/MF $30.00 CSCL 06N

Studies on design and anthropometric fit tests of military clothing, protective clothing and equipment; anthropometric and human factors engineering design of aircraft seats and cabins, cockpits, ejection seats, automobile interiors, safety belts and devices, life jackets, flotation devices, and other safety equipment are presented. Studies on simulation models to model the human body in crash research and to model limb or whole body motion as well are also covered. In addition, references on anthropometric surveys and anthropometric and human factors engineering aspects of workspace configuration and instrument panel design for boots, aircraft and the like are cited. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N81-12737# Royal Aircraft Establishment, Farnborough (England).

THE RECORDING AND PRELIMINARY ANALYSIS OF A DATA BASE FOR THE ASSESSMENT OF STRAIN IN AIR TRAFFIC CONTROLLERS, USING SPEECH

J. B. Peckham London HMSO Jun. 1980 13 p refs

(RAE-TM-FS-334; BR75080) Avail: NTIS HC A02/MF A01

A data base of air traffic controllers verbal communications during periods of high and low activity was tape recorded during the Farnborough International Airshow in 1978. A description of the data base was obtained to provide a means of testing the hypothesis that the speech signal can be used to assess strain or the effects of increasing stress in work. Preliminary statistical analysis of the voice pitch of one of the controllers has shown that periods of high and low activity may be readily discriminated using several 20 second segments of voiced speech. Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-12738# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

PERFORMANCE OF THE SCOTT AVIOX EMERGENCY OXYGEN SYSTEM AFTER EXPOSURE TO NORMAL, HOT AND COLD STORAGE CONDITIONS

Jun. 1980 31 p refs

(AD-A090572; DCIEM-80-R-28) Avail: NTIS HC A03/MF A01 CSCL 01/3

With the advent of the Long Range Patrol Aircraft (LRPA) the CP-140 Aurora, the Canadian Forces will not only be acquiring a new aircraft but a new supplemental oxygen system as well. This system is the Scott Aviox which is a solid state system that utilizes a chemical composition for oxygen production versus more conventional methods of stored liquid or gaseous oxygen. Although this type of system is not new in the aviation world, it is only now being adopted for use in the CF. Because of the novelty of this system in the CF, this evaluation study was conducted to determine the units ability to meet criteria established in regards to reliability, production and ability to operate after being exposed to temperature extremes. GRA

N81-12739# Letterman Army Inst. of Research, San Francisco, Calif.

LABORATORY INVESTIGATIONS OF BIOMEDICAL FACTORS INFLUENCING LASER DESIGNATOR OPERATOR PERFORMANCE

Peter A. Omara, David A. Stamper, Edwin S. Beatrice, and David J. Lund Jun. 1980 14 p

(AD-A090425) Avail: NTIS HC A02/MF A01 CSCL 05/9

A field simulation laboratory has been constructed which will facilitate the controlled investigation of factors which may influence laser designator operations. The primary objectives in developing this laboratory were to obtain accurate low-cost on-line assessment of pursuit tracking performance under conditions where experimental variables could be precisely controlled. The results of the preliminary studies indicate that the tracking performance data obtained with the use of the laboratory laser designator simulator are consistent with those obtained under field conditions in which prototype viscous-mounted laser designator devices are used. The methods and results outlined in this report demonstrate the feasibility of using relatively inexpensive microcomputer, laser, and video electronic systems to study human tracking performance in a laboratory situation where biomedical variables which influence soldier performance may be monitored under precisely controlled conditions. The data obtained through use of the simulator will be of value during the selection and training of designator operators and will provide information for use in developing means of protecting the operator from the effects of hazardous environments. GRA

N81-12740# Army Aeromedical Research Lab., Fort Rucker, Ala. Human Tolerance and Survivability Div.

SPH-4 HELMET DAMAGE AND HEAD INJURY CORRELATION Final Report, Apr. 1975 - Jun. 1979

Bruce A. Slobodnik Sep. 1980 26 p refs

(DA Proj. 3E1-62773-A-819)

(AD-A090750; USAARL-80-7) Avail: NTIS HC A03/MF A01 CSCL 01/2

Human tolerance to head impact was assessed by correlating the force levels required to duplicate damage seen in 12 SH-4 aviator helmets retrieved from US Army helicopter crashes with resulting head injury. Head injury occurred at peak acceleration levels far below 400 G, which is the value currently used by the US Army as the pass-fail criterion in evaluating the impact attenuation performance of prospective aircrew helmets. Concussive head injuries occurred below Severity Index values of 1500 and below Head Injury Criterion values of 1000. These are considered concussive threshold values by the National Operating Committee on Standards for Athletic Equipment and by the Department of Transportation, respectively. GRA

N81-12741# Cincinnati Univ., Ohio. Dept. of Mechanical and Industrial Engineering.

ON PARACHUTIST DYNAMICS Technical Report, 1 Oct. 1978 - 30 Sep. 1980

Ronald L. Huston and James W. Kamman 1 Oct. 1980 56 p refs

(Contract N00014-76-C-0139)

(AD-A090335; UC-MIE-100180-10-ONR) Avail: NTIS HC A04/MF A01 CSCL 05/5

The dynamics of a parachutist is discussed. Results of a computer simulation and a parameter study are presented. A variety of initial parachutist configurations prior to 'opening shock' are considered and the relative effects upon the parachutist's dynamics-particularly, the head/neck system dynamics are studied. Optimal initial (pre-opening) configurations which minimize the subsequent force and moment pulses experienced by the head/neck system, are identified and discussed. Application in parachute design and in developing jumping strategies are also discussed. GRA

N81-12742# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

MATHEMATICAL MODELS OF PILOT-HELICOPTER SYSTEMS

P. H. Wewerinke 27 Jun. 1979 22 p refs Presented at 5th European Rotocraft and Powered Lift Aircraft Forum, Amsterdam, 4-7 Sep. 1979

(NLR-MP-79026-U) Avail: NTIS HC A02/MF A01

A theoretical framework in terms of state space optimization, estimation and decision theory is presented, to allow the description of meaningful (relevant with respect to overall system reliability) pilot functional characteristics. This involves continuous information processing both of display indicators and of the outside world resulting in an internal representation of the task. In the case of control tasks this information processing model is combined with a control response model. This is known as the optimal control model. Preliminary attempts to model pilot monitoring and decision making are described. The resulting integrated model of the man machine system provides measures of pilot workload and system performance. It is shown that the model is a useful tool to deal with many design and operational problems of pilot-helicopter systems. Author (ESA)

N81-12743# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

VISUAL SCENE PERCEPTION IN MANUAL CONTROL

P. H. Wewerinke 23 Jan. 1980 28 p refs Submitted for publication

(NLR-MP-79045-U) Avail: NTIS HC A03/MF A01

Based on an inventory of the most important visual scene characteristics, the visual perception process is described on the

basis of the linear perspective geometry and cues related to the relative movement of the observer with respect to the outside world. This involves mathematical relationships between these visual cues and the vehicle state variables. The visual scene provides a variety of perspective geometrical and relative motion cues. Experimental results support the hypothesis that these characteristics can be considered as separate cues among which the human operator must divide his attention. No interference was found between tasks. The visual scene perception model is shown capable of providing a general framework for dealing quantitatively with the important visual scene characteristics. Integrating this model with the optimal control model of human control behavior allows a detailed description of the visual perception process involved in the visual approach task.
Author (ESA)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

N81-12744*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
USER'S MANUAL FOR MMLE3, A GENERAL FORTRAN PROGRAM FOR MAXIMUM LIKELIHOOD PARAMETER ESTIMATION
Richard E. Maine and Kenneth W. Iliff Nov. 1980 90 p refs
(NASA-TP-1563; H-1084) Avail: NTIS HC A05/MF A01 CSCL 09B

A user's manual for the FORTRAN IV computer program MMLE3 is described. It is a maximum likelihood parameter estimation program capable of handling general bilinear dynamic equations of arbitrary order with measurement noise and/or state noise (process noise). The theory and use of the program is described. The basic MMLE3 program is quite general and, therefore, applicable to a wide variety of problems. The basic program can interact with a set of user written problem specific routines to simplify the use of the program on specific systems. A set of user routines for the aircraft stability and control derivative estimation problem is provided with the program. Author

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N81-12745*# Sperry Univac, St. Paul, Minn.
INVESTIGATION OF MULTILAYER MAGNETIC DOMAIN LATTICE FILE Interim Report
E. J. Torok, M. Kamin, and C. H. Tolman Nov. 1980 125 p refs
(Contract NAS1-15007)
(NASA-CR-159324; PX-13393; PS-1229) Avail: NTIS HC A06/MF A01 CSCL 09B

The feasibility of the self structured multilayered bubble domain memory as a mass memory medium for satellite applications is examined. Theoretical considerations of multilayer bubble supporting materials are presented, in addition to the experimental evaluation of current accessed circuitry for various memory functions. The design, fabrication, and test of four device designs is described, and a recommended memory storage area configuration is presented. Memory functions which were demonstrated include the current accessed propagation of bubble domains and stripe domains, pinning of stripe domain ends, generation of single and double bubbles, generation of arrays of coexisting strip and bubble domains in a single garnet layer, and demonstration of different values of the strip out field for single and double bubbles indicating adequate margins for data detection. All functions necessary to develop a multilayer self structured bubble memory device were demonstrated in individual experiments. M.G.

N81-12746*# Radio Corp. of America, Van Nuys, Calif. Electromagnetic and Aviation Systems Div.
DESIGN, DEVELOPMENT, FABRICATION AND DELIVERY OF REGISTER AND MULTIPLEXER UNITS Final Report
A. Feller and T. Lombardi Aug. 1978 56 p refs
(Contract NAS8-25582)
(NASA-CR-150801) Avail: NTIS HC A04/MF A01 CSCL 09B

Several approaches for implementing the register and multiplexer unit into two CMOS monolithic chip types were evaluated. The CMOS standard cell array technique was selected and implemented. Using this design automation technology, two LSI CMOS arrays were designed, fabricated, packaged, and tested for proper static, functional, and dynamic operation. One of the chip types, multiplexer register type 1, is fabricated on a 0.143 x 0.123 inch chip. It uses nine standard cell types for a total of 54 standard cells. This involves more than 350 transistors and has the functional equivalent of 111 gates. The second chip, multiplexer register type 2, is housed on a 0.12 x 0.12 inch die. It uses 13 standard cell types, for a total of 42 standard cells. It contains more than 300 transistors, the functional equivalent of 112 gates. All of the hermetically sealed units were initially screened for proper functional operation. The static leakage and the dynamic leakage were measured. Dynamic measurements were made and recorded. At 10 V, 14 megabit shifting rates were measured on multiplexer register type 1. At 5 V these units shifted data at a 6.6 MHz rate. The units were designed to operate over the 3 to 15 V operating range and over a temperature range of -55 to 125 C. M.G.

N81-12747*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE LARGE SCALE MICROELECTRONICS COMPUTER-AIDED DESIGN AND TEST (CADAT) SYSTEM
John M. Gould Oct. 1978 21 p refs
(NASA-TM-78202) Avail: NTIS HC A02/MF A01 CSCL 09B

The CADAT system consists of a number of computer programs written in FORTRAN that provide the capability to simulate, lay out, analyze, and create the artwork for large scale microelectronics. The function of each software component of the system is described with references to specific documentation for each software component. A.R.H.

N81-12748# Naval Air Development Center, Warminster, Pa. Software and Computer Directorate.
DFT DECOMPOSITION AND IMPLEMENTATION FOR CONCURRENT EXECUTION ON MULTIPLE PROCESSING ELEMENTS Interim Report
Richard S. Mejzak 1 Oct. 1980 28 p refs
(WF21200000)
(AD-A090725; NADC-80110-50) Avail: NTIS HC A03/MF A01 CSCL 09/2

One of the tasks being performed for the Microprocessor Applications to Avionics project, sponsored by Air-360B, is the development of an experimental distributed microprocessor subsystem as a vehicle to investigate distributed processing concepts at the subsystem or node level. The experimental distributed microprocessor subsystem consists of six microprocessors that employ a shared memory for communications and control. The first phase of this effort will implement and demonstrate concurrent and cooperative use of these microprocessors to perform a selected application function. This report defines a distributed processing concept in terms of control primitives,

variables, and structures and their use in performing a decomposed DFT (Discrete Fourier Transform) application function. GRA

N81-12749# Naval Postgraduate School, Monterey, Calif.
THE DESIGN AND IMPLEMENTATION OF THE MEMORY MANAGER FOR A SECURE ARCHIVAL STORAGE SYSTEM M.S. Thesis
Edmund E. Moore and Alan V. Gary Jun. 1980 166 p refs
(AD-A090313) Avail: NTIS HC A08/MF A01 CSCL 09/2

This thesis presents a detailed design and implementation of a memory manager for a kernel technology based secure archival storage system (SASS). The memory manager is a part of the nondistributed portion of the security kernel, and is solely responsible for the proper management of both the main memory (random access) and the secondary storage (direct access) of the system. The memory manager is designed for implementation on the ZILOG Z8000 microprocessor in a multi-processor environment. The loop free design structure, based upon levels of abstraction, and a segment aliasing scheme for information confinement are essential elements of the overall system security provided by the SASS. GRA

N81-12750# Washington Univ., Seattle. Dept. of Computer Science.
***ON DEVELOPING A THEORY OF DISTRIBUTED COMPUTING* SUMMARY OF CURRENT RESEARCH**
Michael J. Fischer Sep. 1980 13 p refs
(Contract N00014-80-C-0221; Grant NSF MCS-77-02474)
(AD-A090773; TR-80-09-03) Avail: NTIS HC A02/MF A01 CSCL 09/2

The paradigms of theory can be applied to the problems of concurrency and distribution to yield a rich mathematical theory which will provide a solid framework for practitioner and theoretican alike to use in gaining greater understanding of the exciting and important area of distributed computing. The author is currently engaged in an effort to develop such a theory. This paper summarizes work to date and indicates directions for further research. GRA

N81-12751# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE GMC SYSTEM FOR CENTRAL MEMORY MANAGEMENT
Yves Gorge 1979 25 p refs In FRENCH; ENGLISH summary
(ONERA-NT-1979-12; ISSN-0078-3781) Avail: NTIS HC A02/MF A01

A software package called GMC is described which facilitates the writing of scientific programs using large data arrays for computers without virtual memory. It is used for a UNIVAC-1100 computer in the form of sub-programs compatible with the FORTRAN ASCII compiler. The main algorithms and the user's manual are described. Author (ESA)

N81-12752# Christian Rovsing Ltd., Copenhagen (Denmark).
***COMPUTER AIDED CONTROL SYSTEM DESIGN*. A CONVERSION REPORT**
J. Balle Jul. 1979 211 p
(Contract ESA-3462/78-NL-AK(SC))
(CRI-110; ESA-CR(P)-1351) Avail: NTIS HC A10/MF A01

The conversion of a computer aided control system design package from running on PDP DEC-10 medium size computer to run on an HP 21 MX mini computer is described. In its original and its converted form the package contains about 30,000 FORTRAN statements and some assembler routines. Detailed documentation of how the conversion was performed is presented. Redesigned components such as the file handling and the graphic implementation are described as well as the conversion techniques used and the acceptance test performed. Author (ESA)

N81-12753# Atomic Weapons Research Establishment, Aldermaston (England).
DATA ACQUISITION FROM A DIGITAL VOLTMETER USING A CBM PET 2001 MICROCOMPUTER WITH PARTICULAR *REFERENCE TO MICROELECTRONIC WIRE BOND TESTING*
R. F. E. Jenkins London Apr. 1980 18 p ref
(AWRE-O-16/80; BR73507; ISBN-0-85518139-7) Avail: NTIS HC A02/MF A01; HMSO £1 PHI

The use of a PET 2001 microcomputer for data acquisition of a binary coded decimal output from a digital voltmeter via the computer's user port is described. The BASIC program deviates into a short machine code routine which is also described. The machine code program is then placed in context with the complete BASIC program for data acquisition, processing, storage, and display. The use of this approach is illustrated in automatic strength testing of wire bonds in microelectronic circuitry. Author (ESA)

N81-12754# British Aerospace Dynamics Group, Bristol (England). Electronics and Space Systems.
***MULTIPURPOSE RECONFIGURABLE SIMULATOR* Final Report**
C. J. Black Paris ESA Jan. 1980 122 p
(Contract ESA-3310/77-NL-AK(SC))
(ESS/SS-983; ESA-CR(P)-1356) Avail: NTIS HC A06/MF A01

The design of a multiprocessor system which permits up to 32 local processors to be operated in parallel as self contained micro/minicomputers interconnected by two buses is described, along with test software. The development standard equipment consists of two local processors, 16K words of common memory, with suitable interfaces to permit an existing Hewlett Packard minicomputer to be used as a third local processor, a bus monitor and a common input/output facility supporting an operator console terminal Author (ESA)

N81-12755# National Technical Information Service, Springfield, Va.
MICROCOMPUTERS: INDUSTRIAL PROCESS CONTROL *APPLICATIONS. CITATIONS FROM THE ENGINEERING* INDEX DATA BASE Progress Report, 1970 - Jun. 1979
Guy E. Habercom, Jr. Jul. 1980 285 p
(PB80-813405) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

This bibliography contains 284 citations in which industrial applications of microcomputers to expedite processes are investigated. Such diversified industries as pulp mills, rubber processing industry, chemical plants, metal fabrication plants, and machine shops are researched to ascertain the effectiveness of microcomputers as a process control tool. Comparative analyses of microcomputers and their control systems are made. GRA

N81-12756# National Technical Information Service, Springfield, Va.
***MICROCOMPUTERS: INDUSTRIAL PROCESS CONTROL* APPLICATIONS. CITATIONS FROM THE ENGINEERING *INDEX DATA BASE* Progress Report, Jul. 1979 - Jun. 1980**
Guy E. Habercom, Jr. Jul. 1980 193 p Supersedes NTIS/PS-79/0731; NTIS/PS-78/0616
(PB80-813413; NTIS/PS-79/0731; NTIS/PS-78/0616) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

This bibliography contains 188 citations in which industrial applications of microcomputers to expedite processes are investigated. Such diversified industries as pulp mills, rubber processing industry, chemical plants, metal fabrication plants, and machine shops are researched to ascertain the effectiveness of microcomputers as a process control tool. Comparative analyses of microcomputers and their control systems are made. GRA

N81-12757# National Technical Information Service, Springfield, Va.
READ ONLY MEMORIES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1980
Jack E. Jones Aug. 1980 122 p Supersedes NTIS/PS-79/0947; NTIS/PS-78/0951
(PB80-814833; NTIS/PS-79/0947; NTIS/PS-78/0951) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 133 citations on the design, development, and application of read only memories is given. Optical read only storage, and software for read only memories in various applications are included. M.G.

N81-12758# National Technical Information Service, Springfield, Va.

COMPUTER STORAGE MANAGEMENT. CITATIONS FROM NTIS DATA BASE Progress Report, 1964 - Aug. 1980
Jack E. Jones Aug. 1980 268 p Supersedes NTIS/PS-79/0884; NTIS/PS-78/0803
(PB80-814759; NTIS/PS-79/0884; NTIS/PS-78/0803) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

This bibliography contains 264 citations which cover dynamic storage allocation, paging, buffer storage, interleaved memory, and virtual memory. Also included are the necessary programs, compilers, and algorithms for implementation in various computer systems. GRA

N81-12759# *Federal Compiler Testing Center, Washington, D.C.*
HONEYWELL INFORMATION SYSTEMS, COBOLA 2.0, LEVEL 6, MOD 0400 COBOL COMPILER Validation Summary Report
16 Jul. 1980 64 p refs
(PB80-204969; CCVS74-VSR615) Avail: NTIS HC A04/MF A01 CSCL 09B

The validation summary report (VSR) for the HIS Level 6 COBOL Compiler Version 2.0 (GOOS6 Version 12.1) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X3.23-1974/FIPS PUB 21-1). The compiler was validated at the high level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies by level/module within X3.23-1974, a section relating the categories of discrepancies to each of the federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-12760*# *National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.*
THE PR2D (PLACE, ROUTE IN 2-DIMENSIONS) AUTOMATIC LAYOUT COMPUTER PROGRAM HANDBOOK
Teddy M. Edge Sep. 1978 256 p refs
(NASA-RP-1029; M-268) Avail: NTIS HC A12/MF A01 CSCL 09B

Place, Route in 2-Dimensions is a standard cell automatic layout computer program for generating large scale integrated/metal oxide semiconductor arrays. The program was utilized successfully for a number of years in both government and private sectors but until now was undocumented. The compilation, loading, and execution of the program on a Sigma V CP-V operating system is described. S.F.

N81-12761*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
GUIDELINES IN PREPARING COMPUTER-GENERATED PLOTS FOR NASA TECHNICAL REPORTS WITH THE LRC GRAPHICS OUTPUT SYSTEM
Nancy L. Taylor Nov. 1980 119 p
(NASA-TM-81908) Avail: NTIS HC A06/MF A01 CSCL 09B

A guideline that deals only with the publication requirements of computer-generated plots is discussed. The rules applied in developing this guideline and examples illustrating the rules are included. S.F.

N81-12762*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF AND CONVERSION BETWEEN DIFFERENT IMPLEMENTATIONS OF THE FORTRAN PROGRAMMING LANGUAGE
Lloyd Treinish Aug. 1980 55 p refs
(NASA-TM-81995) Avail: NTIS HC A04/MF A01 CSCL 09B

A guideline for computer programmers who may need to exchange FORTRAN programs between several computers is presented. The characteristics of the FORTRAN language available on three different types of computers are outlined, and procedures and other considerations for the transfer of programs from one type of FORTRAN to another are discussed. In addition, the variance of these different FORTRAN's from the FORTRAN 77 standard are discussed. Author

N81-12763# Polytechnic Inst. of New York.
SOFTWARE TEST MODELS AND IMPLEMENTATION OF ASSOCIATED TEST DRIVERS Interim Report, Jan. 1978 - Jun. 1979
Dennis L. Baggi and Martin L. Shooman Griffiss AFB, N.Y. RADC Mar. 1980 43 p refs
(Contract F30602-78-C-0057; AF Proj. 2304)
(AD-A089997; POLY-EE-79-0057; RADC-TR-80-45) Avail: NTIS HC A03/MF A01 CSCL 09/2

In the past, more software tests were constructed by heuristics and by drawing upon experience with similar software. Recently, enough preliminary work has been done to propose an analytical construction of test cases. This report begins by defining five broad classes of software tests: type 0, type 1, type 2, type 3 and type 4. In a type 0 test, all instructions are exercised at least once. In a type 1 and 2 test, all flowchart paths are exercised at least once. Type 1 is performed by forced traversal and type 2 by natural execution. Types 3 and 4 correspond to an exhaustive interaction of all input and stored data. Clearly, types 3 and 4 are unfeasible and only a strategy lying between type 1 and 2 can effectively be implemented. Since enumeration of all the paths in a given program is required for type 1 and 2 tests, this report establishes the lower and upper bounds on the number of paths as a function of the number of deciders, describes a manual decomposition procedure to cut a graph into smaller subgraphs, and proposes an algorithm to machine-identify all paths. A complete type 1.5 driver system for forced path traversal, implemented in PL/1, is then thoroughly described, together with suggestions on how to extend these techniques to other languages. A typical program is analyzed manually, tested with data and run through the system. Some evaluation of the usefulness of the system is eventually given in the light of the accumulated experience. GRA

N81-12764# *University of Southeastern Massachusetts, North Dartmouth. Dept. of Electrical Engineering.*
TWO EXPERIMENTS ON STATISTICAL IMAGE SEGMENTATION
C. H. Chen and Chihsung Yen 15 Sep. 1980 29 p refs
(Contract N00014-79-C-0494)
(AD-A089484; SMU-EE-TR-80-9) Avail: NTIS HC A03/MF A01 CSCL 09/2

Recently there has been considerable research interest in applying statistical pattern recognition theory to image segmentation. As the image is rich in statistical information, effective segmentation of images into meaningful parts can be performed by using statistical techniques. In this report, we present segmentation results on infrared and reconnaissance images using two different statistical pattern recognition methods. The first experiment is on the Alabama data base infrared images using the Fisher's linear discriminant analysis (1). To preserve the inter-pixel dependence as much as possible, measurements are taken in the form of a 3 x 3 matrix. That is we are dealing with matrix measurements instead of vector measurements as typically considered in statistical pattern recognition. GRA

N81-12765# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
A SPECIAL-PURPOSE PROCESSOR FOR AN AUTOMATIC FEATURE EXTRACTION SYSTEM Final Report, 1 Nov. 1979 - 31 Jul. 1980
John V. Oldfield Aug. 1980 15 p refs
(Grant AF-AFOSR-0070-80; AF Proj. 2305)
(AD-A090789; AFOSR-80-1072TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

The design of a special-purpose vector-type processor particularly applicable to image-processing tasks is discussed. The advantages of parallel processing are described. Particular attention is paid to the register structure of the proposed processor and to the design of a suitable crossbar switch. GRA

N81-12766# Texas Univ. at Austin. Software and Data Base Engineering Group.

AN INTEGRATED METHODOLOGY AND TOOLS FOR SOFTWARE DEVELOPMENT Final Report

Daniel Chester and Raymond T. Yeh Aug. 1980 27 p refs (Grant AF-AFOSR-3409-77)

(AD-A090347; SDBEG-20) Avail: NTIS HC A03/MF A01 CSCL 09/2

This research has developed a methodology for the development of software and several tools to help the designers of software systems. The methodology incorporate models of various aspects of a system under development. They include models of how efficiently the system will perform, what function the system will compute, and what alternatives the designers have considered and decided against. The methodology was applied to data base systems, where it works in a way that agrees with present experience with those systems. The tools that were developed include models of system performance, specification languages, a design documentation language, facilities for modelling conceptual entities and several ways to control the complexity of processes that are operating in parallel (concurrent programs). GRA

N81-12767# Maryland Univ., College Park. Dept. of Computer Science.

A COMPARATIVE ANALYSIS OF FUNCTIONAL CORRECTNESS

Douglas D. Dunlop and Victor R. Basili Aug. 1980 26 p refs (Contract F49620-80-C-0001)

(AD-A090487; TR-921) Avail: NTIS HC A03/MF A01 CSCL 09/2

The functional correctness technique is presented and explained. An implication of the underlying theory for the derivation of loop invariants is discussed. The functional verification conditions concerning program loops are shown to be a specialization of the commonly used inductive assertion verification conditions. The functional technique is compared and contrasted with subgoal induction. Finally, the difficulty of proving initialized loops is examined in light of the inductive assertion and functional correctness theories. GRA

N81-12768# Honeywell Systems and Research Center, Minneapolis, Minn.

REFERENCE MANUAL FOR THE ADA PROGRAMMING LANGUAGE. PROPOSED STANDARD DOCUMENT

Jean D. Ichbiah, Bernd Krieg-Brueckner, Brian A. Wichmann, Henry F. Ledgard, Jean-Claude Heliard, Jean-Raymond Abrial, John G. P. Barnes, Mike Woodger, Olivier Roubine, Paul N. Hilfinger et al Jul. 1980 237 p Prepared in cooperation with CII Honeywell Bull, Paris (France)

(ARPA Order 3341)

(AD-A090709) Avail: NTIS HC A11/MF A01 CSCL 09/2

Ada is the result of a collective effort to design a common language for programming large scale and real-time systems. This report is the proposed standard document for Ada. Since the early 70's, DOD has been committed to the use of High Order Languages and has developed an extensive set of requirements for a single language which could be adopted for use throughout DOD. In April 1978, the language designed by Jean Ichbiah and his team at Honeywell/CII-Honeywell Bull, Paris, France, was chosen to be the new DOD language. For the ensuing fourteen months, Ada was subjected to an intense period of test and evaluation by the international computer science community and the design was modified in response to language issues raised during the test and evaluation. It will be added to the list of approved languages for use in DOD systems and promises to have a significant impact on DOD software development. Ada will be reviewed under American National Standards Institute (ANSI) canvass procedures for designation as an American National Standard and is on the agenda for the International Standards Organization (ISO). The DOD is concentrating on the development of compilers and an integrated programming support environment for Ada software. Although developed for use in DOD systems, Ada has generated considerable interest in the international computing community, particularly NATO, as well as in the U.S. commercial computing community. GRA

N81-12769# Saab-Scania, Goteberg (Sweden).

SOME ASPECTS ON IMPROVEMENTS OF A FIRST-ORDER DYNAMIC OPTIMIZATION ALGORITHM

Bernt Jaemark 1980 21 p refs

(SAAB-TN-AE-73) Avail: NTIS HC A02/MF A01

Several improvements of a first order differential dynamic programming method are discussed. These were tested and appear to be useful on optimal flight trajectory applications. Some convergence difficulties are due to instability in the differential equations or different sensitivity in the control within different time intervals. A simplified second order algorithm is used. To obtain better accuracy and stability when approaching or when close to optimum solution. A first order method is suggested for free terminal time. Author (ESA)

N81-12770# Systems Designers Ltd., Camberley (England).

RELIABLE SOFTWARE: STANDARDS FOR THE PRODUCTION OF HIGH QUALITY SYSTEMS Summary Report

M. G. Bailey, A. A. Levene, and G. P. Mullery Paris ESA May 1980 15 p refs

(Contract ESA-3385)

(ESA-CR(P)-1358) Avail: NTIS HC A02/MF A01

Software development standards for future ESA satellite systems are presented. Trends in the development of high quality software are reviewed. A set of standards suited to ESA onboard software is described. The implementation of a specific automated aid (a modified version of the RELAY assembler), to assist in the development of high quality onboard software is discussed. Author (ESA)

N81-12771# Royal Signals and Radar Establishment, Malvern (England).

GRAPH THEORY LEADS TO PROGRAM VISIBILITY

B. D. Bramson and S. J. Goodenough London May 1980 19 p refs

(RSRE-80004; BR75534) Avail: NTIS HC A02/MF A01

The control flow analysis of a computer program is discussed as a first step towards proving its correctness. The program defines a directed graph whose nodes represent instructions and whose arcs determine their logical connectivity. Condensation produces a new graph whose nodes are whole cyclic regions of the old graph. Node reduction transforms the original graph into a set of graphs, with fewer nodes, that encapsulate the control flow of the original program but at a higher level. Information extracted from the program is determined by the type of nodes that are eliminated. Programs are classified into six structural forms. Author (ESA)

N81-12772# Royal Signals and Radar Establishment, Malvern (England).

POSER: A PROCESS ORGANIZATION TO SIMPLIFY ERROR RECOVERY

J. A. McDermid London Jan. 1980 8 p refs

(RSRE-MEMO-3249; BR72727) Avail: NTIS HC A02/MF A01

A process organization is described which was developed to make automatic error recovery simpler than with conventional process organizations. A high level description of the process and of the channels (which provide the data communication), is presented. Aspects of the organization are given which were implemented within a multicomputer simulation in ALGOL 68 RT. The checkpointing and error recovery mechanisms which would be used are briefly mentioned. Author (ESA)

N81-12773# National Technical Information Service, Springfield, Va.

PROGRAMMING LANGUAGE DESIGN. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Aug. 1980

Jack E. Jones Aug. 1980 194 p Supersedes NTIS/PS-79/0979; NTIS/PS-78/0963

(PB80-814767; NTIS/PS-79/0979; NTIS/PS-78/0963) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

The bibliography cites research reports on the design, development, and implementation of programming languages. The citations include specifications and applications for the programming languages in systems development, and their use in specific cases. The report also includes research on language compilers,

syntax, semantics and logic modules. This updated bibliography contains 189 citations, 7 of which are new entries to the previous edition. GRA

N81-12774# National Technical Information Service, Springfield, Va.
AUTOMATIC PROGRAMMING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Jack E. Jones Aug. 1980 97 p Supersedes NTIS/PS-79/0945; NTIS/PS-78/0920
(PB80-813637; NTIS/PS-79/0945; NTIS/PS-78/0920) Avail: NTIS HC$30.00/MF$30.00 CSCL 09B

Principles and applications of automatic programming are cited in this bibliography of Government-sponsored research reports. The programming languages used in automatic programming, techniques for debugging, and semantic models are included. This updated bibliography contains 92 citations, 7 of which are new entries to the previous edition. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N81-12775# Royal Signals and Radar Establishment, Malvern (England).
AN OVERVIEW OF RELIABLE COMPUTER SYSTEM DESIGN
J. A. McDermid London May 1980 30 p refs
(RSRE-80003; BR75035) Avail: NTIS HC A03/MF A01

An overview of reliable computer system design is presented. A pragmatic guide to redundancy and recovery is given, without discussing either the theory or philosophy of reliable systems. The basic concepts of reliability are defined and the basic mechanisms for achieving fault tolerance are described. The attributes of multi-processor and multi-computer systems from the point of view of reliability are compared. The techniques for achieving tolerance to both hardware and software faults are detailed. Some of the major unsolved problems of reliable system design are outlined. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N81-12776 Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
AUTOMATIC SCENE ANALYSIS. SECOND CONTRACT REPORT [ANALYSE DE SCENES AUTOMATIQUE. SECOND RAPPORT DE CONTRAT]
M. Grafer Nov. 1979 160 p refs Partly in FRENCH and ENGLISH
(ENST-D-79024) Avail: NTIS HC A08

The design of an analysis module for industrial robot application was studied. The module is the most important element in the interface between the environment associated with the task to be executed by the robot and the way in which the situation is perceived. An iterative synthesis approach is employed. Emphasis is given to generating mechanisms and comparisons between masks and images arising in an adapted data structure. Examples are given. Author (ESA)

N81-12777# SRI International Corp., Menlo Park, Calif. Computer Science Lab.
ON THE SUITABILITY OF ADA FOR ARTIFICIAL INTELLIGENCE APPLICATIONS
Richard L. Schwartz and P. M. Melliar-Smith Jul. 1980 37 p refs
(Contract DAAG29-79-C-0216; ARPA Order 2894; SRI Proj. 1019)
(AD-A090790; ARO-17127.1-A-EL) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report summarizes the results of our analysis of the suitability of the Department of Defense (DOD) programming language Ada for Artificial Intelligence (AI) applications. As Ada is expected to become a major programming language in the 1980's with widespread usage in both the military and commercial sectors, a reasonable question to be asked is whether Ada could benefit the efforts of AI system development or transfer. A large store of language and environment support tools are expected to appear within the next several years. The ability for the AI community to avail themselves of such technology would serve the needs of both AI systems developers and the ultimate recipients of the developed technology. In this report, we consider the suitability of the Preliminary Ada Language Specification either as a language for the development of AI systems or as a language for the transfer of already-developed AI technology. We focus our attention on the language capabilities required to support AI paradigms and their realization in Ada. GRA

N81-12778# Brown Univ., Providence, R. I. Lefschetz Center for Dynamical Systems.
EXISTENCE OF OPTIMAL CONTROLS FOR PARTIALLY OBSERVED DIFFUSIONS Interim Report
Wendell H. Fleming and Etienne Pardoux (IRIA-Laboria, Le Chesnay, France) Jul. 1980 58 p refs
(Grants AF-AFOSR-3092-76; NSF MCS-79-03554; AF Proj. 2304)
(AD-A090537; AFOSR-80-1003TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we are concerned with the existence of optimal controls for problems of the following kind. The state and observation processes are governed by stochastic differential equations. Instead of allowing only strict-sense controls, we obtain existence of a minimum in a wider class of controls. Our results together with a counterexample of Varadhan strongly suggest that, if there is indeed a general existence theorem for strict sense optimal controls, then standard methods are not adequate to prove it. There is a similar difficult in proving existence of optimal controls with complete observations with singular noise coefficient, if the term 'complete observations' is taken in the strict sense that depends on the past of the Wiener process driving the system. GRA

N81-12779# Delaware Univ., Newark. Applied Mathematics Inst.
ALGORITHMIC SOLUTION OF SOME QUEUES WITH OVERFLOWS Interim Report
Marcel F. Neuts and Seshavadhani Kumar Apr. 1980 24 p refs
(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)
(AD-A090771; AFOSR-80-0993TR; TR-51B) Avail: NTIS HC A02/MF A01 CSCL 12/1

The overflow stream from an M/PH/1 queue of finite capacity is used as the input to an unbounded queue with one or more exponential servers. It is shown that the combined system, consisting of the two queues, may be studied as a highly structured Markov process. In the stable case, this Markov process has a matrix-geometric invariant vector. Particular features of the infinitesimal generator of the process may be used to simplify the numerical computation of various steady-state features of the model. Several variants and numerical examples are discussed. GRA

N81-12780# Washington Univ., Seattle. Dept. of Computer Science.
OPTIMAL RESOURCE PLACEMENT IN A DISTRIBUTED SYSTEM (EXTENDED ABSTRACT)
Michael J. Fischer, Nancy D. Griffith, and Nancy A. Lynch Aug. 1980 12 p refs Prepared in cooperation with Georgia Inst. of Tech., Atlanta
(Contracts N00014-80-C-0221; DAAG29-79-C-0155)
(AD-A090772; TR-80-08-03) Avail: NTIS HC A02/MF A01 CSCL 12/1

Consider the problem of locating t resources on the nodes of a complete binary tree of n leaves so as to minimize the expected total distance from each of t simultaneous random requests at the leaves to the resource with which each is optimally matched. The optimal placement of resources yields an expected

total distance of at most ct + 2 log(n/t). Such a placement can be found in time O(log n). GRA

N81-12781# Technische Univ., Berlin (West Germany). Fachberiech Informatik.
AUTOMATIC CONSTRUCTION OF SEMANTIC NETWORKS Final Report
Vladmir Cherniavsky, Herbert Engel, Christopher Habel, Helmuth Huismann, Claus-Rainer Rollinger, Arno Schmidt, Hans Jochen Schneider, Heinz Schweppe, and Juen-tin Wang Bonn Bundesministerium fuer Forschung und Technologie Dec. 1979 264 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-ID-79-05; ISSN-0340-8647) Avail: NTIS HC A12/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 55,45

Computer methods for the automatic construction of semantic networks from natural language input were developed. A question-answer strategy to show the adequacy and effectiveness of these methods is discussed. The implementation of the logical components in an information processing system is described. Data processing elements consist of an experimental system which allows for the input and the retrieval of information through use of a first order language, and a natural language interface for communication with data base systems. As an improvement to the system, processing complex logic which depends on complete and implicit knowledge is considered in terms of interferential methods. The complete system as a user oriented information retrieval system is examined in application to the fields of medicine and law. Author (ESA)

N81-12782# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
EXPERIMENTS ON SPEECH RECOGNITION BY LINEAR PREDICTION [EXPERIENCES EN RECONNAISSANCE DE LA PAROLE PAR PREDICTION LINEAIRE]
Laurent Miclet and Antoine Nehme Sep. 1979 12 p refs In FRENCH Presented at 2nd Congr. Reconnaissance des Formes et Intelligence Artificielle, Toulouse, 12-14 Sep. 1979
(ENST-C-79020) Avail: NTIS HC A02/MF A01

An experimental comparison between the behavior observed with various signal/speech distances is presented together with an accelerated procedure for calculating these distances. The purpose was to select a fast and reliable linear prediction method which is of sufficiently high quality to serve as a basis for continuous speech recognition. The improvements that can be made in this way are described. Author (ESA)

N81-12783# National Technical Information Service, Springfield, Va.
CLOSED LOOP CONTROL SYSTEMS: MISCELLANEOUS APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Jun. 1980
Guy E. Habercom, Jr. Jul. 1980 153 p Supersedes NTIS/PS-79/0906; NTIS/PS-78/0810
(PB80-813702; NTIS/PS-79/0906; NTIS/PS-78/0810) Avail: NTIS HC $30.00/MF $30.00 CSCL 12A

Closed loop control systems are investigated relevant to design, application, and performance. Such diversified applications as gas turbine engine controls, feedback control of spacecraft and missiles, wind tunnel flow control, nuclear power plant systems, and feedback control of laser pulses are examined. This updated bibliography contains 154 citations, 86 of which are new entries to the previous edition. GRA

N81-12784# National Technical Information Service, Springfield, Va.
PATTERN RECOGNITION AND IMAGE PROCESSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, Aug. 1979 - Jul. 1980
Brian Carrigan Aug. 1980 246 p Supersedes NTIS/PS-79/0872; NTIS/PS-78/0846
(PB80-814239; NTIS/PS-79/0872; NTIS/PS-78/0846) Avail: NTIS HC 30.00/MF $30.00 CSCL 09B

Research reports on pattern recognition and image processing are cited. Research on processing color pictures, image enhancement and restoration, feature extraction, edge detection, and scene analysis are included. This updated bibliography contains 244 abstracts, all of which are new entries to the previous edition. Author

N81-12785# National Technical Information Service, Springfield, Va.
PATTERN RECOGNITION AND IMAGE PROCESSING. CITATIONS FROM THE NTIS DATA BASE Progress Report, Aug. 1977 - Jul. 1979
Brian Carrigan Aug. 1980 189 p
(PB80-814221) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 284 citations is presented addressing pattern recognition and image processing. Processing color pictures, image enhancement and restoration, feature extraction, edge detection, and scene analysis are discussed. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-12786*# Miami Univ., Coral Gables, Fla. Dept. of Electrical Engineering.
DEVELOPMENT OF BOOLEAN CALCULUS AND ITS APPLICATIONS Final Report, Aug. 1977 - 31 Dec. 1980
Moiez A. Tapia 31 Dec. 1980 71 p refs
(Grant NsG-1436)
(NASA-CR-163802) Avail: NTIS HC A04/MF A01 CSCL 12A

The development of Boolean calculus for its application to developing digital system design methodologies that would reduce system complexity, size, cost, speed, power requirements, etc., is discussed. Synthesis procedures for logic circuits are examined particularly asynchronous circuits using clock triggered flip flops. M.G.

N81-12787# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
FINITE ELEMENT ANALYSIS OF A DYNAMICALLY LOADED FLAT LAMINATED PLATE Final Report, Nov. 1976 - Mar. 1979
Adam R. Zak and Daniel W. Pillasch Jul. 1980 123 p refs (Contract DAAD05-77-C-0722)
(AD-A089985; AD-E430494; ARBRL-CR-00433) Avail: NTIS HC A06/MF A01 CSCL 12/1

A finite element structural model has been developed for the dynamic analysis of laminated, thick plates. The model uses quadrilateral elements to represent the shape of the plate and the elements are stacked in the thickness direction to represent various material layers. This analysis allows for orthotropic, elastic-plastic or elastic-viscoplastic material properties. Nonlinear strain displacement relations are used to represent large transverse plate deflections. A finite difference technique is used to perform the numerical time integration. Assumptions are made about the response through the thickness of the plate that allows for the use of relatively large time increments in the numerical integration method. These led to a set of element equilibrium equations which help to keep small errors from affecting the values of stress that are calculated. The results from the analytical model are compared with experimental results. A good agreement is found between the calculated and measured values of the transverse plate deflections. GRA

N81-12788# Washington Univ., Seattle. Dept. of Computer Science.
DECIDABILITY AND EXPRESSIVENESS OF LOGICS OF PROCESSES Ph.D. Thesis
Karl Raymond Abrahamson Aug. 1980 178 p refs
(Contract N00014-80-C-0221; NR Proj. 049-456)
(AD-A090688; TR-80-08-01) Avail: NTIS HC A09/MF A01 CSCL 12/1

Several logics of process are defined and examined with a particular emphasis on general process logic (GPL) and modal process logic (MPL). A tableau method is presented for deciding validity in MPL, based on a type of directed graph, called an LL graph. From the tableau method a complete proof system for

MPL is derived. Differences between MPL and GPL are discussed in addition to extensions of proportional dynamic logic. M.G.

N81-12789# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EFFICIENT MULTIPLIERS FOR THE FFT
S. C. Pohlig and J. M. Frankovich 15 Jul. 1980 23 p refs
(AD-A090648) Avail: NTIS HC A02/MF A01 CSCL 09/3

One of the major components in a hardware implementation of the discrete Fourier transform (DFT) is the multiplier hardware. There are algorithms available which reduce the number of multiplication used in computing the DFT, and there are hardware techniques for implementing multipliers. This paper presents an efficient method of using table lookup multipliers for the fat Fourier transform (FFT). This method implements the multipliers with a small number of modest size tables. GRA

N81-12790*# Lexington Labs., Inc., Cambridge, Mass.
CONVERGENCE OF ITERATIVE NONEXPANSIVE SIGNAL RECONSTRUCTION ALGORITHMS
Victor T. Tom, Thomas F. Quatieri, Monson H. Hayes, and James H. McClellan 1 Aug. 1980 37 p refs
(Grant NAG5-2; Contract F19628-80-C-0002; AF Proj. 4594) (NASA-CR-163799; AD-A090689; TN-1980-21; ESD-TR-80-88) Avail: NTIS HC A03/MF A01 CSCL 12/1

A convergence proof of a special class of iterative signal reconstruction problems is presented. The proof relies on the concept of nonexpansive mappings which impose partial knowledge of the unknown signal in both the time and frequency domains. Two examples studied in detail are time limited extrapolation and phase-only reconstruction. The proof of convergence for the phase-only iteration is a new result. The generality of the approach allows the incorporation of nonlinear constraints such as positivity or minimum and maximum values. Finally, the under-relaxed form of these iterations is shown to converge when the solution is not necessarily unique. GRA

N81-12791# Mitre Corp., Bedford, Mass.
THE MULTIPLE STACK ALGORITHM IMPLEMENTED ON A ZILOG Z-80 MICROCOMPUTER Interim Report
Howard H. Ma Griffiss AFB, N.Y. RADC Jul. 1980 95 p refs
(AD-A090606; MTR-3843; RADC-TR-80-232) Avail: NTIS HC A05/MF A01 CSCL 17/2

A new sequential decoding algorithm, the multiple stack algorithm or MSA, has been implemented and tested on a Zilog Z-80 microcomputer system. The results of this implementation, when compared to those of a (2,1) 8 Viterbi algorithm implemented on the same microcomputer system, show that the MSA obtains significantly higher data throughput. These results suggest the feasibility of a real-time implementation of codes with along constraint lengths (in excess of eight) on small, low-cost microprocessors. GRA

N81-12792# Army Armament Research and Development Command, Dover, N. J.
NONLINEAR CHI-SQUARE ALGORITHM: AN IMPROVEMENT ON NONLINEAR LEAST SQUARES
Richard L. Moore Jun. 1980 15 p refs
(AD-A090420) Avail: NTIS HC A02/MF A01 CSCL 12/2

Because of the high cost of testing, many large weapon systems cannot be tested over the full range of possible battlefield parameters. As a result, the developer and the reviewing authorities have come to rely on system simulation to demonstrate the system capability over the range of untested parameters. These simulations also are useful to investigate the change in performance resulting from possible subsystem modifications. In some important programs, the Government relies on simulations of competing systems to indicate the relative performance of these systems in situations for which no tests have been made, although of course, simulations such as these have been validated as much as possible by system tests. In these instances the procurement decision rests heavily on the validity of the system simulations. Consequently the need arises for a generally accepted procedure which is undoubtedly fair to each contractor and provides the maximum amount of objective judgment about the validity of the simulation. In any such procedure the Government must be able to rapidly evaluate simulations furnished from a variety of sources. GRA

N81-12793# Los Alamos Scientific Lab., N. Mex.
GRAPHS OF THE CROSS SECTIONS IN THE ALTERNATE MONTE CARLO CROSS SECTION LIBRARY AT THE LOS ALAMOS SCIENTIFIC LABORATORY
R. E. Seamon and P. D. Soran Jun. 1980 10 p refs
(Contract W-7405-eng-36)
(LA-8394-MS) Avail: NTIS HC A02/MF A01

Graphs of all neutron cross sections and photon production cross sections on the Alternate Monte Carlo Cross Section (AMCCS) library were plotted along with local neutron heating numbers. The values of v-bar, the average number of neutrons per fission, were also plotted for appropriate isotopes. DOE

N81-12794# Bendix Corp., Kansas City, Mo.
QUADRIC SOLIDS AND COMPUTATIONAL GEOMETRY
J. D. Emery 25 Jul. 1980 66 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2484) Avail: NTIS HC A04/MF A01

The mathematics underlying the program QUADRIC, which does computations on objects modeled as Boolean combinations of quadric half spaces, are discussed. Topics considered include projective space, quadric surfaces, polars, affine transformations, the construction of solids, shaded image, the inertia tensor, moments, volume, surface integrals, Monte Carlo integration, and stratified sampling. DOE

N81-12795# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.
SOME SINGULAR INTEGRAL EQUATIONS IN LINEAR TRANSPORT THEORY
Thomas W. Mullikin (Purdue Univ., West Lafayette, Ind.) Jul. 1980 21 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1069) Avail: NTIS HC A02/MF A01

Solutions to the steady state transport equation for one speed, isotropic scattering in a half space can be found from singular integral equations with Cauchy principal value integrals. Galerkin methods for these equations are studied with special emphasis on sensitivity of approximation errors to choice of basis. DOE

N81-12796# Sandia Labs., Albuquerque, N. Mex.
CDC 6600/7600 SUBROUTINE FOR BESSEL FUNCTIONS Y/SUB Nx X < 0, nu < OR = 0
D. E. Amos Aug. 1980 17 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1498) Avail: NTIS HC A02/MF A01

Formulas for Y sub nu(x) and Y sub nu + 1(x) are implemented on invervals $0 < x <$ or $= 3,3 < x < 20$, $x >$ or $= 20$, and $-1/2 <$ to start forward recursion for N member sequences Y sub nu + k -1(x), k = 1,..., N. A recursive form of the power series is used on $0 < x <$ or $= 3$, while the backward recursive Miller algorithm applied to a confluent hypergeometric representation is implemented on $3 < x < 20$. For $x >$ or $= 20$, Y sub nu(x) and Y(sub nu + 1)(x) are computed from the asymptotic expansion for x approaches infinity. If the intial order nu is larger than NULIM, the sequence is started by using the uniform asymptotic expansion for nu approaches infinity. Here NULIM = 70 if N = 1 or NULIM = 100 if N > 1. Overflow tests are made on the leading term of the uniform asymptotic expansion for large orders and small x. DOE

N81-12797# Princeton Univ., N. J. Plasma Physics Lab.
MAXWELL-VLASOV EQUATIONS AS A CONTINUOUS HAMILTONIAN SYSTEM
Philip J. Morrison Sep. 1980 13 p refs
(Contract DE-AM02-76CH-03073)
(PPPL-1702) Avail: NTIS HC A02/MF A01

The well-known Maxwell-Vlasov equations that describe a collisionless plasma were cast into Hamiltonian form. The dynamical variables were the physical although noncanonical variables E, B and f. A Poisson bracket which acts on these variables and the energy functional to produce the equations of motion are presented. DOE

N81-12798# Brookhaven National Lab., Upton, N. Y.
IMPROVED NUMERICAL TECHNIQUES FOR PROCESSING MONTE CARLO THERMAL SCATTERING DATA
Eldon Schmidt and Philip Rose 1980 5 p refs

(BNL-28048; CONF-801107-11) Avail: NTIS HC A02/MF A01

The National Nuclear Data Center calculated thermal reactor lattices using the SAM-F Monte Carlo computer code. The adequacy of the numerical procedures used to process the thermal differential scattering cross sections for hydrogen bound in water was significantly improved. A new scattering kernel was generated at 296 K using the Haywood phonon frequency spectrum. T.M.

N81-12799# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A NATURAL DATA TYPE WITH A FINITE EQUATIONAL FINAL SEMANTICS SPECIFICATION BUT NO EFFECTIVE EQUATIONAL INITIAL SEMANTICS SPECIFICATION

J. A. Bergstra (Leiden Univ.) and J. V. Tucker Apr. 1980 14 p refs Submitted for publication

(MC-IW-133/80) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Initial and final algebra semantics are two ways of assigning a unique meaning to an axiomatic specification (sigma, E) of a data type. It is easy to find natural data types with effective specifications with respect to initial algebra semantics, but without effective specifications with respect to final algebra semantics. A natural source of data types for which the opposite is true are those programming systems with undecidable program equivalence problems. The situation when the denotational semantics of a system are the primitive recursive functions is worked out in detail. Author (ESA)

N81-12800# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

A NOTE ON TWO INTEGRALS RELATED WITH BESSEL FUNCTIONS

N. M. Temme Mar. 1980 12 p refs Submitted for publication

(MC-TW-199/80) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Two integrals are studied which appear as terms in expansions of the Green functions for the solution of two and three dimensional turbulent diffusion problems. These functions are written first as confluent hypergeometric functions and expansions are given for the numerical evaluation. The relation with modified Bessel functions is described. Mellin transform techniques are used for proving the identities. Author (ESA)

N81-12801# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

NONLINEAR FINITE ELEMENT ANALYSIS: AN ALTERNATIVE FORMULATION

Silvio Merazzi (Ecole Polytechnique Federale de Lausanne, Switzerland) and Peter Stehlin 2 Sep. 1980 19 p refs Presented at Symp. on Computational Methods in Nonlinear Struct. Mech., Hampton, Va. 6-8 Oct. 1980

(Contracts NE-5061-013; SNSF-2267-079)

(FFA-TN-HU-2189-Pt-2) Avail: NTIS HC A02/MF A01

As part of the development of the BASIS finite element analysis system a geometrical nonlinear analysis based on an alternative definition of strain is presented. Expressions for strain are obtained by computing the change in length of the base vectors in the curvilinear element coordinate system. The isoparametric element formulation is assumed in the global cartesian coordinate system. The approach is based on the minimization of the strain energy, and the resulting nonlinear equations are solved by the modified Newton method. Integration of the first and second variation of the strain energy is performed numerically in the case of two and three dimensional elements. Application is made to a simple long cantilever beam, which may represent and elastic wind turbine blade with large deformations. Author (ESA)

N81-12802# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

FINITE ELEMENT ANALYSIS OF CRACK GROWTH

G. Bartelds and A. U. Dekoning 17 Sep. 1980 26 p refs Presented at 2nd World Congr. on Finite Elem. Method, Bournemouth, England, 23-27 Oct. 1978

(NLR-MP-78017-U) Avail: NTIS HC A03/MF A01

The phenomenon of crack growth as it manifests itself in contemporary metal structure is reviewed. The governing parameters that emerged from previous analysis of experimental data or from model description of crack growth are established. The application of finite element procedures to the determination of these parameters is discussed. The state-of-the-art in the area of crack growth prediction is reviewed and the potential of finite element procedures to improve the prediction capabilities is indicated as well as the limitations involved. Author (ESA)

N81-12803 Illinois State Univ., Normal.

AN ALGORITHM MODULE FOR ABSTRACT ALGEBRA Ph.D. Thesis

Kenneth Koe-Nan Chao 1980 209 p

Avail: Univ. Microfilms Order No. 8024303

An exposition of algorithmic solutions to problems in abstract algebra is presented. Checking for associativity, and finding conjugacy classes in groups is described. The instructional package consists of a module for the student and a manual for the instructor suitable to serve as a supplementary text to accompany an introductory course in abstract algebra, or for a short course or independent study project. It was designed to develop a student's algorithmic way of thinking in abstract algebra through demonstration, evaluation, application, and development of algorithms. The instructional package consists of four units entitled: Algorithms; Algorithms on Associativity; Algorithms on Conjugacy Classes; and An Algorithm Developed from the Snap Method. Dissert. Abstr.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-12804 Saab-Scania, Linkoping (Sweden).

ON A GENERAL ASYMPTOTIC INDEPENDENCE: RESULT IN STATISTICS, A PRELIMINARY REPORT

Bo Bergman 1979 13 p refs

(SAAB-FTK-0-79-22) Avail: NTIS HC A02

A general asymptotic independence result applicable both to life table analysis and to fixed interval analysis is presented. The method described assumes that there are g quantities (q sub 1, ..., q sub g) each constructed from a sequence of independent random variables and that these sequences are conditionally independent given their random lengths. Then by the completion of each sequence with independent random variables, g independent sequences are obtained. Under rather general assumptions asymptotic properties of the original sequences are deduced from the corresponding properties of the completed sequences. It is often possible to prove the asymptotic independence of the quantities q sub 1, ..., q sub g. Author (ESA)

N81-12805# Brown Univ., Providence, R. I. Center for Dynamical Systems.

STOCHASTIC APPROXIMATION WITH DISCONTINUOUS DYNAMICS AND STATE DEPENDENT NOISE W.P.1 CONVERGENCE Interim Report

Harold J. Kushner 10 Jul. 1980 26 p refs

(Contract N00014-76-C-0279; Grants AF-AFOSR-3063-76; NSF ENG-77-12946; AF Proj. 2304)

(AD-A089777; AFOSR-80-0866TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Stochastic approximations might not be continuous and the noise sequence (xi sub n) might depend on (X sub n). An 'averaging' and an 'ordinary differential equation' method are combined to get w.p.1 convergence for both the above algorithm and for the case where the iterates are projected back onto a bounded set G if they ever leave it. Two examples are developed, the first being an automata problem where the dynamics are not smooth and the noise is state dependent, and the second a Robbins-Monro process with observation averaging (which causes the noise to be state dependent). Each example is typical of a larger class. GRA

N81-12806# Massachusetts Univ., Amherst. Dept. of Mathematics and Statistics.

NONPARAMETRIC TESTS OF INDEPENDENCE FOR CENSORED DATA Final Technical Report
Ramesh M. Korwar and Ram C. Dahiya Jul. 1980 7 p refs (Contract F49620-79-C-0105; AF Proj. 2304)
(AD-A090330; AFOSR-80-0948TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

The work accomplished by six technical reports was already issued. Papers based on two of them are accepted for publication and are soon to be published in two of the leading journals in statistics. One other is submitted for publication. And yet another will appear in Proceedings of a Conference on Nonparametric Statistics. GRA

N81-12807# Tennessee Univ., Knoxville. Dept. of Mathematics.
EQUIVALENT GAUSSIAN MEASURES WHOSE R-N DERIVATIVE IS THE EXPONENTIAL OF A DIAGONAL FORM Interim Report
Dong M. Chung and Balram S. Rajut Dec. 1979 28 p refs (Contract N00014-78-C-0468)
(AD-A090787; TR-7906) Avail: NTIS HC A03/MF A01 CSCL 12/1

A simple necessary and sufficient condition, on a trace-class kernel K, is given in order for the existence of a measurable (relative to the completed product sigma-algebra) Gaussian process with covariance K. Using this result, sufficient conditions are given on the means and the covariances (relative to two equivalent Gaussian measures P and P sub lambda) of a process X so that the Radon-Nikodym (R-N) derivative dp sub lambda/dP is the exponential of the diagonal form in X. Analogues of the last two results in the set up of Hilbert space are also proved. GRA

N81-12808# North Carolina Univ. at Chapel Hill.
IN SEARCH OF CORRELATION IN MULTIPLICATIVE CONGRUENTIAL GENERATORS WITH MODULUS (2 TO THE 31ST POWER) MINUS 1
George S. Fishman and Louis R. Moore, III Sep. 1980 55 p refs
(Contract N00014-76-C-0302)
(AD-A090636; TR-80-5) Avail: NTIS HC A04/MF A01 CSCL 09/2

This paper describes an empirical search for correlation in sample sequences produced by 16 multiplicative congruential random number generators with modulus 2 to the 31st power minus 1. Each generator has a distinct multiplier. One multiplier is in common use in the LLRANDOM and IMSL random generation packages as well as in APL and SIMPL/1. A second is used in SIMSCRIPT 2. Six multipliers were taken from a recent study that showed them to have the best spectral and lattice test properties among 50 multipliers considered. The last eight multipliers had the poorest spectral and lattice test properties for 2 tuples among the 50. A well known poor generator, RANDU, with modulus 2 to the 31st power, was also tested to provide a benchmark for evaluating the empirical testing procedure. GRA

N81-12809# North Carolina Univ. at Chapel Hill. Dept. of Statistics.
ON LIMITING DISTRIBUTIONS OF INTERMEDIATE ORDER STATISTICS FROM STATIONARY SEQUENCES
Vernon Watts, Holger Rootzen, and M. R. Leadbetter May 1980 27 p refs
(Contract N00014-75-C-0809)
(AD-A090617; MIMEO-SER-1284) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of finding the asymptotic distribution of the maximum term from a stationary dependent sequence of random variables (r.v.'s) has been extensively investigated in the literature. Of particular interest are the cases in which the concept of 'approximate independence' is formulated mathematically in terms of conditions such as 'strong mixing' or, for 'normal sequences, conditions on the rate of decay of the covariances. Our objective in this paper is to obtain analogous results for so-called intermediate order statistics. A sequence is given of intermediate order statistics and intermediate rank sequence. These conditions parallel those used to obtain the corresponding result in the extreme order statistic problem, a primary difference being that certain more rapid 'mixing' rates have to be assumed. Using our procedure it is convenient to deal directly with an appropriate level exceedance problem and to regard that of asymptotic distributions as a specialization. GRA

N81-12810# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.
ON THE SMOOTHNESS OF MARKOV CHAIN TRANSITION FUNCTIONS
Torgny Lindvall 1980 13 p refs
(CTH-Math-1980-5) Avail: NTIS HC A02/MF A01

A coupling method to determine smoothness results for Markov chain transition functions and their derivatives is presented. Rate results of the type first established by Pitman are obtained for the derivatives of the transition functions, under moment conditions on the recurrence times between visits paid to a reference state. Author (ESA)

N81-12811# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
CLINES IN THE PRESENCE OF ASYMMETRIC MIGRATION
J. P. Pauwelussen and L. A. Peletier (Leiden Univ.) Apr. 1980 50 p refs Submitted for publication
(MC-TW-200/80) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

If a population, which consists of individuals having genetic variation at one locus, with two alleles A and a, evolves under the influence of migration and selection, gradients in the distribution of alleles may arise. The effect of asymmetry in the migration and spatial dependence of the selection process, upon the emergence and stability of such gradients is studied. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-12812*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
OPTIMAL REGULATION IN SYSTEMS WITH STOCHASTIC TIME SAMPLING
Raymond C. Montgomery and Peter S. Lee Hampton, Va. Nov. 1980 29 p refs
(NASA-TP-1743; L-13507) Avail: NTIS HC A03/MF A01 CSCL 12B

An optimal control theory that accounts for stochastic variable time sampling in a distributed microprocessor based flight control system is presented. The theory is developed by using a linear process model for the airplane dynamics and the information distribution process is modeled as a variable time increment process where, at the time that information is supplied to the control effectors, the control effectors know the time of the next information update only in a stochastic sense. An optimal control problem is formulated and solved for the control law that minimizes the expected value of a quadratic cost function. The optimal cost obtained with a variable time increment Markov information update process where the control effectors know only the past information update intervals and the Markov transition mechanism is almost identical to that obtained with a known and uniform information update interval. Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-12813# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
APPLICATIONS OF EFFICIENT SUBSET SELECTION TO DIGITAL FILTERING AND TO SIGNAL RESOLUTION Final Report
Jafir Khorammi and Donald Tufts Aug. 1980 104 p refs
(Grant AF-AFOSR-3174-77; AF Proj. 2304)

(AD-A090128; AFOSR-80-0954TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

The subset selection algorithm is extended to search for a best subset from a large set of complex-valued basis functions. This algorithm is used to design digital finite-duration impulse response (FIR) filters having fewer coefficients than conventional FIR filters. An optimum conventional FIR filter is derived which has best uniform spacing of the fixed number of samples which are to be used, and examples are presented which show that, for the same number of coefficients, the complex-subset-selection filter can give better results than the optimum conventional filter. The complex subset selection method is also applied to estimation of the frequencies of sinusoids in the presence of noise. A windowing technique is introduced to increase the efficiency and accuracy of the algorithm for frequency estimates. The results are compared with Cramer-Rao bounds. GRA

N81-12814# Brown Univ., Providence, R. I. Lefschetz Center For Dynamical Systems.

ASYMPTOTIC BEHAVIOR FOR A STRONGLY DAMPED NONLINEAR WAVE EQUATION Interim Report

Paul Massatt Jun. 1980 15 p refs

(Grant AF-AFOSR-3092-76; AF Proj. 2304)

(AD-A090548; AFOSR-80-1002TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper is a specific application of the author's recent paper, on 'Limiting Behavior for Strongly Damped Nonlinear Wave Equations' where results of Webb and Fitzgibbon were extended by applying results of a few recent papers written by the author. Some of the main results of this paper are to show boundedness of orbits in one space implies boundedness of orbits in other spaces (the technique here provides an interesting alternative proof of the main results of Alikakos. Invariant sets in one space are automatically invariant sets in many spaces (which implies smoothness properties of invariant sets), point dissipative and compact dissipative are equivalent in many spaces and imply bounded dissipative in spaces of 'smoother' functions, the existence of a 'very smooth' maximal compact invariant set under a very weak dissipative assumption, along with its strong stability and attractivity properties in several spaces, and fixed point theorems under these weak dissipative hypotheses. GRA

N81-12815# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

A HISTORICALLY MOTIVATED STUDY OF FAMILIES OF PYTHAGOREAN OR BABYLONIAN TRIPLES AND THEIR GENERATING SEMIGROUPS OF P- OR B-ORTHONORMAL MATRICES

Joeran Friberg 1980 116 p refs

(CTH-Math-1980-3) Avail: NTIS HC A06/MF A01

The role played by the triple S,T,V of basic generator matrices of the Lorentz orthonormal 3 X 3 matrices in Pythagorean triples generation was studied as well as the characteristic properties of the matrices S,T,V themselves and their positive powers. The approach used is to work simultaneously with the Pythagorean triples and their parameter pairs, related to each other by a well known parametrization formula. Several problems known since ancient history are recalled and analyzed, including the Babylonian triples known as solutions of certain trapezoid partition problems. Author (ESA)

N81-12816# Chalmers Univ. of Technology, Goteborg (Sweden). Dept. of Mathematics.

A CHARACTERIZATION OF GORENSTEIN ORDERS IN QUATERNION ALGEBRAS

Juliusz Brzezinski 1980 9 p refs Prepared in cooperation with Goeteborg Univ., Sweden

(CTH-Math-1980-6) Avail: NTIS HC A02/MF A01

A characterization of Gorenstein orders in quaternion algebras is presented with orders corresponding by means of a natural construction, to lattices on the quadratic space consisting of quaternions with trace equal to 0 and with quadratic structure given by the reduced norm. This characterization gives a possibility to apply the theory of Gorenstein orders to lattices (quadratic forms) on ternary quadratic spaces. A generalization to arbitrary characterics of a classical result of Brandt about invertibility of submodules in quaternion algebras is given. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-12817*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORETICAL MODEL APPLICABLE TO THE EXPERIMENTAL DETERMINATION OF SURFACE ANCHORING ENERGIES OF NEMATIC LIQUID CRYSTALS M.S. Thesis

Edwin G. Wintucky Nov. 1980 34 p refs

(NASA-TM-81628; E-637) Avail: NTIS HC A03/MF A01 CSCL 20B

For a cell configuration consisting of a thin nematic layer bounded by two parallel plane surfaces, with opposing surfaces suitably treated to produce dissimilar molecular orientations, the elastic continuum theory for nematic liquid crystals was applied to derive an expression relating surface anchoring energies to elastic constants, director orientations at the substrate surfaces, and cell thickness. A numerical comparison with the elastically isotropic result over a range K sub 3 = 1.5 K sub 1 to K sub 3 = 10 K sub 1 showed the effect of elastic anisotropy could be quite significant. Surface anchoring energies calculated for anisotropic of K sub 3 = 2 K sub 1 and K sub 3 + 10 K sub 1 were approximately 50% and 500%, respectively, than the isotropic values. Author

N81-12818# California Univ., Berkeley. Lawrence Berkeley Lab.

PHYSICAL AND OPTICAL PROPERTIES OF RARE EARTH COBALT MAGNETS

Klaus Halbach Aug. 1980 25 p refs Presented at the Intern. Conf. on Charged Particle Optics, Giessen, West Germany, 8 Sep. 1980

(LBL-11393; CONF-800952-1) Avail: NTIS HC A02/MF A01

Rare earth cobalt permanent magnets have properties that permit solutions to some optical tasks that cannot be accomplished with conventional magnets. The design and performance characteristics of these magnets are reviewed and the three dimensional fringe fields of REC quadrupoles are described. DOE

N81-12819# Oak Ridge National Lab., Tenn.

DETERMINATION OF COEFFICIENTS FOR THE UNIVERSAL LAWS OF FRICTION AND HEAT TRANSFER FOR CFTL CALCULATIONS

S. A. Hodge Aug. 1980 27 p refs

(Contract W-7405-eng-26)

(ORNL/TM-7418) Avail: NTIS HC A03/MF A01

The friction factor and Stanton number for flow past a roughened surface are determined by the parameters A and R(h+) of the universal law of friction and A sub H and G(h+) of the universal law of heat transfer. The methods to be used for determination of these parameters for the particular roughness to be used in the core flow test loop are presented. Examples are given concerning the application of these methods to both transitional and fully rough flow. DOE

N81-12820# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

THE CISE TANDEM VANDEGRAAF ACCELERATOR AND ITS FIELDS OF USE

E. Caruso and F. Cristofori Feb. 1979 32 p refs

(CISE-N-191) Avail: NTIS HC A03/MF A01

Research applications discussed include: elemental analysis by proton induced X-ray fluorescence; backscattering photometry; and radiation damage in metals. The terminal voltage of the accelerator reaches 3.5 MV. The auxiliary equipment is briefly described. The accelerable ions are listed with the respective charge state and final intensity and energy. Author (ESA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-12821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ACOUSTIC TRANSMISSION MATRIX OF A VARIABLE AREA DUCT OR NOZZLE CARRYING A COMPRESSIBLE SUBSONIC FLOW

J. H. Miles 1980 39 p refs Presented at the One-Hundredth Meeting of the Acoust. Soc. of Am., Los Angeles, 17-21 Nov. 1980

(NASA-TM-81614; E-613) Avail: NTIS HC A03/MF A01 CSCL 20A

The differential equations governing the propagation of sound in a variable area duct or nozzle carrying a one dimensional subsonic compressible fluid flow are derived and put in state variable form using acoustic pressure and particle velocity as the state variables. The duct or nozzle is divided into a number of regions. The region size is selected so that in each region the Mach number can be assumed constant and the area variation can be approximated by an exponential area variation. Consequently, the state variable equation in each region has constant coefficients. The transmission matrix for each region is obtained by solving the constant coefficient acoustic state variable differential equation. The transmission matrix for the duct or nozzle is the product of the individual transmission matrices of each region. Solutions are presented for several geometries with and without mean flow. J.M.S.

N81-12822*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A COMPARISON OF THE THREE METHODS USED TO OBTAIN ACOUSTIC MEASUREMENTS FOR THE NASA FLIGHT EFFECTS PROGRAM

Arnold W. Mueller Oct. 1980 37 p refs

(NASA-TM-81906) Avail: NTIS HC A03/MF A01 CSCL 20A

The NASA Flight Effects Program has a requirement to compare acoustic data obtained from flyover, static test stand, and wind tunnel tests. Results of a laboratory study of the acoustic characteristics of the three techniques used to measure noise during these tests are presented. Recommendations are made to allow for a comparison of data obtained with each technique. Author

N81-12823# Pennsylvania State Univ., University Park. Dept. of Engineering Science and Mechanics.

PARAMETRIC ACOUSTIC CONVERSION-EFFICIENCY ENHANCEMENT VIA BOUNDARY INDUCED AND INHERENT DISPERSIVITY Annual Summary Report, 1 Sep. 1979 - 31 Aug. 1980

Francis H. Fenlon and Joseph E. Fahy 31 Aug. 1980 44 p refs

(Contract N00014-79-C-0624)

(AD-A090329) Avail: NTIS HC A03/MF A01 CSCL 17/1

A brief summary of work completed by the authors during the period 9/1/79 - 8/31/80 on the investigation of dispersive wave mechanisms for enhancing the conversion efficiency of parametric acoustic arrays is presented via a detailed review of the physical concepts underlying the investigation, an in-depth review of the theoretical models upon which the investigation is based, and a summary of results obtained to date, followed by a statement of continuing objectives. GRA

N81-12824# Army Research and Technology Labs., Moffett Field, Calif. Aeromechanics Lab.

TRANSONIC ROTOR NOISE - THEORETICAL AND EXPERIMENTAL COMPARISONS

F. H. Schmitz and Y. H. Yu 1980 29 p refs Presented at the 6th European Rotorcraft and Powered Lift Aircraft Forum, Bristol, England, 16-19 Sep. 1980

(AD-A090806; Rept-22) Avail: NTIS HC A03/MF A01 CSCL 20/1

Two complementary methods of describing the high-speed rotor noise problem are discussed. The first method uses the second-order transonic potential equation to define and characterize the nature of the aerodynamic and acoustic fields and to explain the appearance of radiating shock waves. The second employs the Ffowcs Williams and Hawkings equation to successfully calculate the acoustic far-field. Good agreement between theoretical and experimental waveforms is shown for transonic hover tip Mach numbers from 0.8 to 0.9. GRA

N81-12825# Rolls-Royce Ltd., Derby (England). Advanced Research Lab.

SHEAR LAYER INSTABILITY NOISE PRODUCED BY VARIOUS JET NOZZLE CONFIGURATIONS

C. J. Moore and D. H. Brierley 1980 8 p refs

(PNR-90018) Avail: NTIS HC A02/MF A01

When a jet shear layer is disturbed by internal or external flow fluctuations at the correct frequency the broadband mixing noise increases. The investigation of this phenomenon is extended to the flow from coaxial and silencer nozzles. It is concluded that a surrounding co-flowing stream tends to suppress the broadband noise caused by instability wave interaction in a jet shear layer if the velocity ratio is greater than 0.5, and that the shear layers produced by jet silencer nozzles do not permit instability waves to grow to sufficient amplitude to produce extra broadband noise. Author (ESA)

N81-12826# European Space Agency, Paris (France).

SPECTRAL ANALYSIS OF NONSTATIONARY RANDOM PROCESSES. APPLICATION TO NOISE OF FLYOVER TYPE Ph.D. Thesis - Paris-Sud Univ.

Max Ernoult Sep. 1980 275 p refs Transl. into ENGLISH of "Analyse Spectrale des Processus Aleatoires non Stationnaires. Application aux Bruits de Type Survol d'Avion", Rept. ONERA-NT-1979 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-24134

(ESA-TT-639; ONERA-NT-1979-4) Avail: NTIS HC A12/MF A01

Nonstationary noise detected by fixed microphones was studied during the passage of a moving acoustic source (e.g., aircraft flyover noise), with the objectives of measuring the noise radiation pattern and characterizing the spatial distribution of the noise. A time frequency representation of the energy of nonstationary random processes and a series of charts which allows the adaptation of the spectral analysis processes to the treatment of nonstationary signals are presented. The characteristics pertaining to the nonstationarity of an aircraft noise determined in the far field, are discussed. Author (ESA)

N81-12827# Royal Aircraft Establishment, Farnborough (England).

NOISE MEASUREMENTS AND THE dB

K. R. Maslen London HMSO Jul. 1980 28 p refs

(RAE-TM-FS-348; BR75369) Avail: NTIS HC A03/MF A01

The conventional use of the dB in studies of acoustic noise can be said to obscure and complicate simple relationships and lead to the possibility of error because of misunderstandings of the nature of logarithms and because the order of the numbers involved is concealed by the compressed scale. Examples of errors and inaccuracies are given and some cases where consideration of noise in terms of rms pressure would be simpler, or would lead to better understanding of the processes involved, are discussed. It is suggested that although the dB may be a convenient unit for many purposes, more emphasis on the physical nature of noise would help in the interpretation of phenomena and prevent some of the confusions that arise, especially in dealing with the general public. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-12828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LOOKING FOR HEAVIER WEAK BOSONS WITH

DUMAND

R. W. Brown (Case Western Univ., Cleveland, Ohio) and F. W. Stecker Oct. 1980 10 p refs Presented at the 1980 DUMAND Summer Workshop Submitted for publication
(Grant NSF PHY-80-08548)
(NASA-TM-82027) Avail: NTIS HC A02/MF A01 CSCL 20H

One or more heavier weak bosons may coexist with the standard weak boson, a broad program may be laid out for a search for the heavier W's via change in the total cross section due to the additional propagator, a concomitant search, and a subsequent search for significant antimatter in the universe involving the same annihilation, but being independent of possible neutrino oscillations. The program is likely to require detectors sensitive to higher energies, such as acoustic detectors. S.F.

N81-12829# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.

APPLICATION OF GAS LASERS TO STUDIES OF FUNDAMENTAL MOLECULAR AND ATOMIC PROCESSES Final Report, 1 Jul. 1975 - 15 Nov. 1979

Ali Javan 12 May 1980 84 p refs
(Contract N00014-76-C-0447; NR Proj. 395-504)
(AD-A090336; Rept-80-5-30-020) Avail: NTIS HC A05/MF A01 CSCL 20/5

Several topics are summarized in the areas of excimer ground state kinetics, coherent pulse evolution in a CO2 amplifier, photopreionization and operation of a multi-atmosphere TEA laser, relaxation of He2 excimers and highly stripped atoms. GRA

N81-12830# California Inst. of Tech., Pasadena. Arthur Amos Noyes Lab. of Chemical Physics.

***DYNAMICS OF REACTIONS INVOLVING HYDROGEN* ATOM OR PROTON TRANSFER SYMMETRIC CASE**

Sep. 1980 44 p refs
(Contract N00014-79-C-0009)
(AD-A090588; CONTRIB-6314; TR-10) Avail: NTIS HC A03/MF A01 CSCL 20/8

A method is devised for treating the transfer of a light particle such as a hydrogen atom or a proton between two heavy particles, for the case of a collinear symmetric reaction AH - A yield A - HA. Polar coordinates (rho, theta) with origin at the origin of the usual mass-weighted skewed-angle potential energy contour plot are employed to simplify the calculation. Symmetric and antisymmetric vibrationally adiabatic states are obtained at each rho. They provide an effective potential for the rho-motion and used to obtain the elastic adiabatic phase shifts for the rho-motion and from them the transfer probability. The rho-motion corresponds approximately to that of the heavy particles and the theta to that of the light one. Semiclassical limiting expressions are obtained and provide a description of light particle tunneling at low energies for heavy-light-heavy particle systems. Numerical comparisons are given and the present approximation is good for the systems investigated.GRA

N81-12831# *College of William and Mary, Williamsburg, Va.* Dept. of Physics.

A STUDY OF THE COLLISIONAL DYNAMICS FOR COLLI-*SIONS OF UF WITH ATOMS AND MOLECULES* Final Report, 1 Jul. 1979 - 30 Jun. 1980

L. D. Doverspike and R. D. Champion Aug. 1980 43 p refs
(Contract F49620-79-C-0219; AF Proj. 2301)
(AD-A090496; AFOSR-80-1062TR) Avail: NTIS HC A03/MF A01 CSCL 07/2

Absolute total cross sections for the collisional decomposition of the negative ion of uranium hexafluoride into its three lowest asymptotic channels in collisions with the rare gases were measured for collision energies ranging from below thresholds for decomposition up to a laboratory collision energy of 500 eV. The experimental results were found to be consistent with the predictions of a two step collision model where the unimolecular decomposition of the excited molecular negative ions is described with a statistical theory. GRA

N81-12832# New York Univ., N. Y. Dept. of Physics.

***THEORETICAL STUDIES RELATING TO THE INTERACTION* OF RADIATION WITH MATTER: ATOMIC COLLISION PROCESSES OCCURRING IN THE PRESENCE OF RADIATION FIELDS Annual Report, 1 Aug. 1979 - 1 Jul. 1980**

1 Oct. 1980 153 p refs
(Contract N00014-77-C-0553)
(AD-A090528; AR-3) Avail: NTIS HC A08/MF A01 CSCL 07/4

Work is reported in the areas of: (1) collisionally-aided radiative excitation; (2) model potential calculations in atom-field-radiation systems; (3) coherence effects in radiative collisions; (4) two level atom radiation pulse; (5) resonance fluorescence in three level systems; (6) modulation spectroscopy; and (7) effects of collisions on atomic coherences. GRA

N81-12833# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.

ELECTRONIC EXCITATION IN MOLECULAR COLLISIONS STRUCTURAL DYNAMIC AND KINETIC CONSIDERATIONS Annual Summary Report, Sep. 1979 - Aug. 1980

R. D. Levine Sep. 1980 10 p refs
(Grant N00014-78-G-0036)
(AD-A090287; ASR-2) Avail: NTIS HC A02/MF A01 CSCL 20/10

The factors governing chemical reactivity with special reference to the role of electronic energy in promoting the reaction and to the production of electronically excited species are examined. The problem is studied both in general terms (i.e., the development of the required theoretical framework) and in application to specific systems. GRA

N81-12834# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.

BEAM-BEAM SIMULATION FOR THE SINGLE-PASS COLLIDER

R. C. Ssh 1980 6 p ref Presented at the 11th Intern. Conf. on High Energy Accelerators, Geneva, 7-11 Jul. 1980
(LBL-10755; CONF-800740-14) Avail: NTIS HC A02/MF A01

The beam-beam interaction for the single pass collider was investigated by means of a computer simulation. The collision of a single intense bunch of electrons with a single intense bunch of positrons was simulated using a macroparticle code in which the interaction between each two macroparticles is calculated directly. The simulation reveals the pinch effect of one bunch upon the other, the luminosity enhancement due to the pinch effect, the attraction between offset bunches, and the large opening angles of particles in the disrupted bunches. Finally, the effects of synchrotron radiation emitted during the collision are simulated. DOE

N81-12835# California Univ., Berkeley. Lawrence Berkeley Lab.

ALGORITHMS AND COMPUTER CODES FOR ATOMIC AND MOLECULAR QUANTUM SCATTERING THEORY, *VOLUME 2*

Lowell D. Thomas, ed. Jul. 1980 164 p refs Presented at the Algorithms and Computer Codes for Atomic and Molecular Quantum Scattering Theory Conf., Argonne, Ill., 25-27 Jun. 1979 and Berkeley, Calif., 26-27 Oct. 1979
(Contract W-7405-eng-48; Grant NSF CHE-77-21305)
(LBL-9501-Vol-2; CONF-790696-Vol-2; NRCC-Proceedings-5)
Avail: NTIS HC A08/MF A01

Eleven different coupled equation codes were brought up on the national resource for computation in chemistry (NRCC) computer, tested against a set of 24 different test problems and made available to the user community. Many of the strengths and weaknesses of the codes were identified. Based on these observations, a hybrid code was developed which is significantly superior to any single code tested. All of the computer programs except VIVS are available upon request from the NRCC. Since an improved version of VIVS is contained in the hybrid program, VIVAS, it was not made available for distribution. The individual program LOGD is, however, available. In addition, programs which compute the potential energy matrices of the test problems are also available. The software library names for tests 1, 2 and 4 are HEH2, LICO, and EN2, respectively. DOE

N81-12836# *Brookhaven National Lab., Upton, N. Y.*

BAG MODEL, THE HYPERSPHERICAL FORMALISM AND THE HEAVY BARYONS

J. M. Richard 1980 6 p refs Presented at Baryon 1980 Conf., Toronto, 14 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28198; CONF-800763-1) Avail: NTIS HC A02/MF A01

The bag model framework is used to discuss the heavy baryons, triple flavored objects like ccc, cbb, etc. A nonrelativistic picture seems justified. It is insisted that the long range interaction consist of a genuine three body force. Once the potential energy of the quarks is determined, the three body Schroedinger equation is solved by the method of hyperspherical expansion. DOE

N81-12837# Rockefeller Univ., New York.
DIFFRACTIVE HADRON DISSOCIATION AT 100 AND 200 GeV
R. L. Cool, K. Goulianos, H. Sticker, and S. N. White 1980 15 p refs Presented at 20th Intern. Conf. on High Energy Phys., Madison, Wis., 17 Jul. 1980
(Contract DE-AC02-76ER-02232)
(DOE/ER-02232/89; CONF-800724-18) Avail: NTIS HC A02/MF A01

The M2/sub x/ and t dependence of the reaction h + p yields X + p (h = pi/sup + -/, K/sup + -/, p/sup + -/) were measured at incident momenta of 100 and 200 GeV/c in the kinematic region 0.025 less than parallel t parallel less than 0.095 (GeV/c)2 and M2/sub x//s less than 0.1. The differential cross sections are exponential in t, vary predominantly as 1/m2 sub x/, and agree well with factorization rules. DOE

N81-12838# Tennessee Univ., Knoxville.
MULTIPLE IONIZATION AND EXCITATION PROCESSES IN SINGLE ION-ATOM COLLISIONS
S. B. Elston 1980 16 p refs Presented at Intern. Conf. on X-ray Processes and Inner-Shell Ionization, Stirling, England, 25 Aug. 1980
(Contract W-7405-eng-26)
(CONF-800859-1) Avail: NTIS HC A02/MF A01

Several experimental methods are discussed, which, by relying on intentionally imposed restrictions such as coincidence requirements and/or special detection geometries, permit measurements differential in important collision parameters. Such multiply differential measurements are necessary for the isolation of particular excitation and ionization mechanisms and provide more stringent tests of existing theories. Emphasis is on single collision phenomena involving primarily heavy ions. DOE

N81-12839# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
RIGID MUFFIN-TIN APPROXIMATION FOR THE ELECTRON-PHONON INTERACTION IN TRANSITION METALS
W. H. Butler 1980 10 p refs Presented at the Intern. Conf. on Phys. of Transition Metals, Leeds, England, 18 Aug. 1980
(Contract W-7405-eng-26)
(CONF-800864-1) Avail: NTIS HC A02/MF A01

Progress in calculating the electron phonon parameters of transition metals was based on either the rigid muffin tin approximation (RMTA) or the fitted modified tight binding approximation (FMTBA). The RMTA was shown to be remarkably accurate for average electron phonon properties, but there are indications that RMTA matrix elements may be too small at low momentum transfer. An attempt was made to demonstrate these assertions concerning the accuracy of RMTA and the numerous electron phonon calculations were placed in a broader perspective by a demonstration of how they can be used to explain the trends in the strength of the electron phonon coupling among the transition metals and the A-15 compounds. DOE

N81-12840# European Organization for Nuclear Research, Geneva (Switzerland).
STUDY OF DIRECT SINGLE PHOTONS AND CORRELATED PARTICLES IN PROTON-PROTON COLLISIONS AT RADICAL s = 62.4 GeV
A. L. S. Angelis (Oxford Univ.), H. J. Besch (Columbia Univ.), B. J. Blumenfeld, L. Camilleri, T. J. Chapin (Rockefeller Univ.), R. L. Cool (Rockefeller Univ.), C. delPapa, L. DiLella, Z. Dimcovski (Rockefeller Univ.), R. J. Hollebeek (Columbia Univ.) et al 1980 21 p refs Presented at the 20th Intern. Conf. on High Energy Physics, Madison, Wis., 17 Jul. 1980
(Contract DE-AC02-76ER-02232)
(DOE/ER-02232/90; CONF-800724-17) Avail: NTIS HC A02/MF A01

A search for direct single photon production was performed. A statistical division of the data sample into the fraction consistent with single photon production and the fraction due to multiphoton decays of neutral hadrons was accomplished by measuring the average conversion probability for the sample in a one radiation length thick converter. Single photons are produced preferentially with no accompanying particles on the same side. The ratio of positive to negative particles on the away side is found to be 3.7 + -1.2 at high x sub E and p sub T for the single photon events. DOE

N81-12841# Rochester Univ., N. Y. Dept. of Chemistry and Physics.
STUDIES OF HEAVY ION REACTIONS AND TRANSURANIC NUCLEI Progress Report, 1 Aug. 1979 - 31 Jul. 1980
John R. Huizenga Jul. 1980 252 p refs
(Contract DE-AS02-76ER-03496)
(COO-3496-75) Avail: NTIS HC A12/MF A01

The study of heavy ion reaction mechanisms is reported. Work was performed in the following areas: the bombarding energy dependence of the 209Bi + 136Xe reaction; the fragment yields for specific Z and A for projectile-like fragments produced in the reaction of 8.3 MeV/u 56Fe ions with targets of 56Fe, 165Ho, 209Bi, and 238U; and time distributions of fragments from delayed fission after muon capture for muonic 235U, 238U, 237Np, 239Pu, and 242Pu. DOE

N81-12842# California Univ., Berkeley. Lawrence Berkeley Lab. Lab. of Chemical Biodynamics.
VECTORIALLY PHOTOINDUCED ELECTRON-TRANSFER PROCESSES ACROSS WATER-ON-OIL INTERFACES OF MICROEMULSIONS
Itamar Willner, John W. Otvos, and Melvin Calvin Jul. 1980 33 p refs Presented at 10th North Eastern Regional Meeting of the Am. Chem. Soc., Potsdam, N.Y. 29 Jun. - 4 Jul. 1980
Submitted for publication
(Contract W-7405-eng-48)
(LBL-11232; CONF-8006111-1) Avail: NTIS HC A03/MF A01

An interfacial model composed of a water-in-oil microemulsion is suggested to provide the separation of intermediary redox species, thereby preventing backreactions. This model is designed to accomplish the photodecomposition of water in two separate water-in-oil microemulsions coupled by a redox reaction. Phase-transfer of one of the redox products from the water-in-oil interface to the continuous organic phase is the principle by which separation is achieved. The oxidation and reduction sites of the general model were constructed. One system includes the photosensitized oxidation of a donor, EDTA, solubilized in the water pool, benzylnicotinamide acts as a primary acceptor that mediates by the phase transfer principle the reduction of a secondary acceptor, dimenthylamino-azobenzene, solubilized in the continuous organic phase. In system two, involving the photosensitized reduction of methyl viologen, by tris (2,2' bipyridine)Ru(2+), thiophenol is used as the donor and its oxidation product is phase transferred to the continuous organic phase. DOE

N81-12843# Fermi National Accelerator Lab., Batavia, Ill.
SEARCH FOR DIRECT PHOTON PRODUCTION AT FERMILAB ENERGIES AND COMPARISON WITH DIRECT PHOTON MEASUREMENTS AT IRS ENERGIES
B. Cox Dec. 1979 9 p refs Presented at the 9th Intern. Symp. on Lepton and Photon Interactions at High Energy, Batavia, Ill., 23-29 Aug. 1979 Sponsored in part by the Research Corp. and NSF
(Contract DE-AC02-76CH-03000)
(FERMILAB-CONF-79/85-EXP; CONF-790885-20) Avail: NTIS HC A02/MF A01

A search for direct photon production was performed at Fermilab in 200 and 300 GeV/c photon Be interactions over a wide range of X/sub F/ and P/sub perpendicular to/. An excess of photons was detected which when interpreted as single photon production yields gamma/pi ratio which averages .070 + -.025 in the region 1.5 <p/sub perpendicular to/ < 4.0 GeV/c and

-.7 < X/sub F/ < .0. This measurement is discussed and compared with the ISR measurements of the gamma/pi ratio in an attempt to infer the energy dependence of direct photo production. DOE

N81-12844# Brookhaven National Lab., Upton, N. Y.
C3,4,5(PLUS) AND NCO(PLUS, MINUS) MOLECULAR ION STRUCTURE DETERMINATION BY COULOMB EXPLOSION
G. Goldring, Y. Eisen (Center for Nuclear Research, Soreo, Israel), and A. Filevich (Comision Nacional de Energia Atomica) Feb. 1980 21 p refs Presented at the Informal Workshop on the Penetration of Charged Particles in Matter Under Extreme Conditions, New York Univ., 3-5 Jan. 1980
(Contract DE-AC02-76CH-00016)
(BNL-27326) Avail: NTIS HC A02/MF A01

The purpose of these experiments is to acquire structural information about molecules through their Coulomb explosion in thin carbon foils. The data presented relate to the structure of C3(-), C4(-), C5(-), NCO(-), and NCO(+) molecular ions where the resulting multiple charged ions from the Coulomb explosion were detected in polycarbonate sheets. A preliminary analysis of the C3(-) and NCO(-) molecular structure data is presented. E.D.K.

N81-12845# Brookhaven National Lab., Upton, N. Y.
MICROCHANNEL PLATE AS A DETECTOR OF MINIMUM IONIZING PARTICLE
K. Oba (Hamamatsu TV Co., Ltd., Japan), P. Rehak, and S. D. Smith 3 Sep. 1980 11 p ref Presented at the Meeting on Miniaturization of High Energy Physics Detectors, Pisa, Italy, 18-20 Sep. 1980
(Contract DE-AC04-76CH-00016)
(BNL-28279; CONF-800976-1) Avail: NTIS HC A02/MF A01

The performance of the micro-channel plate (MCP) electron multiplier as a detector of the minimum ionizing particles is investigated using 3 GeV negatively charged particles and 7 GeV protons. Special attenuation is directed towards detection efficiency measurement, and timing properties. From the above measurement the feasibility of using MCP as an active target with a good spatial and time resolution is investigated of the MCP detector. A fast particle penetrating the plate crosses a large number of channel walls. If a secondary electron is emitted and goes into the channel, it can generate an electron avalanche in subsequent stages of the detector. The multiplication process in MCP retains the spatial information so the track image can be made visible on the phosphoric anode. MCP has the possibility to detect the minimum ionizing particles with a time resolution of sigma approximately equals 100 ps and with a spatial resoltuion of approximately 10-20 microns. M.G.

N81-12846# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
TRAPPED ELECTRON MODIFICATIONS TO TEARING MODES IN THE LOW COLLISION FREQUENCY LIMIT
P. J. Catto and M. N. Rosenbluth Jul. 1980 55 p refs
(Contract DE-AC03-76-ET-53057)
(SAI-245-80-348-LJ; PRI-6) Avail: NTIS HC A04/MF A01

In the limit of weak collisions a narrow boundary layer forms at the trapped/untrapped boundary in velocity space. When the electron collision frequency nu/sub e/ is small compared to the wave frequency omega times the inverse aspect ratio epsilon a realistic collision operator must be employed to evaluate the response of the boundary layer electrons. The parallel current carried by the barely circulating boundary layer electrons results in tearing mode modifications which are evaluated from a slab model in the banana regime (nu/sub e/ < epsilon omega) by using a Lorentz model collision operator. DOE

N81-12847# Los Alamos Scientific Lab., N. Mex.
GRAPHS OF THE CROSS SECTIONS IN THE RECOMMENDED MONTE CARLO CROSS SECTION LIBRARY AT THE LOS ALAMOS SCIENTIFIC LABORATORY
P. D. Soran and R. E. Seamon May 1980 429 p refs
(Contract W-7405-eng-36)
(LA-8374-MS) Avail: NTIS HC A19/MF A01

Graphs of all neutron cross sections and photon production cross sections on the Recommended Monte Carlo Cross Section library were plotted along with local neutron heating numbers. Values for anti v, the average number of neutrons per fission, are also given. DOE

N81-12848# Naval Research Lab., Washington, D. C. Plasma Technology Branch.
ANALYSIS OF PROTON TRANSPORT EXPERIMENTS
F. C. Young, F. L. Sandel, S. J. Stephanakis, P. G. Blauner, G. Cooperstein, S. A. Goldstein, and D. Mosher 5 Sep. 1980 27 p refs
(Contract DE-AI01-77DP-40042)
(NRL-MR-4322) Avail: NTIS HC A03/MF A01

Intense 1 MeV proton beams, produced with the GAMBLE 2 generator were transported efficiently over a distance of one meter in a wall stabilized current carrying plasma channel. Ion beams from a pinch reflex diode were ballistically focused in a neutral gas background so that a current neutralized beam was injected into the plasma channel. Channels with diameters of 1.6 cm and 4.5 cm were studied for gas pressures ranging from 0.1 to 1.5 Torr. Proton currents in the channels were diagnosed with absolutely calibrated prompt gamma detectors using the F19(p,alpha gamma)O16 reaction. Temporal measurements are compared with calculated prompt gamma responses to provide proton energy losses, proton currents and transport efficiencies. For the small diameter channel, poor transport was observed. For the large diameter channel, efficient transport (33% to 100%) was deduced for peak proton currents of approximately 0.3 MA and for energy losses of a few hundred keV. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-12849# Committee on Science and Technology (U. S. House).
THE MAGNETIC FUSION ENERGY PROGRAM: ITS OBJECTIVES AND PACE
Washington GPO 1980 59 p Hearing before the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 67, 11 Dec. 1979
(GPO-56-764) Avail: SOD HC

The hearings before the House Subcommittee on Energy Research and Production to examine the activities of the magnetic fusion energy program are presented. Cost and schedule characteristics for various demonstration plant development plans are discussed. Research and development options for tandem mirror and Tokamak fusion concepts are analyzed. M.G.

N81-12850# Naval Research Lab., Washington, D. C. Plasma Physics Div.
LASER FUSION STUDIES AT NRL
J. McMahon, J. Orens, S. Bodner, D. Book, J. Boris, R. Decoste, M. Emery, M. Fritts, J. Gardner, and S. Gold 8 Oct. 1980 21 p refs
(AD-A090116; NRL-MR-4350) Avail: NTIS HC A02/MF A01 CSCL 18/1

The NRL group is studying the technical feasibility of high gain laser fusion pellets driven by low irradiance (10 to the 14th power W per sq cm) multi-nanosecond lasers. In earlier experiments, it was shown that both absorption and hydrodynamic efficiencies were consistent with high gain pellet designs. In addition to extending this work to greater intensities and larger spot sizes, research is underway on the origins and magnitude of target preheating at low irradiance, on experimental and theoretical work on the issue of symmetry and into the related questions of Rayleigh-Taylor instability and mixing of layers in multi-layer targets. Substantial progress has been made in all of these areas: the rear surfaces of slab targets have been ablatively accelerated to velocites above 10 to the 7th power cm/sec with acceptably low levels of preheat and there is experimental

evidence of smoothing of spatial non-uniformities in the laser profile on a transverse scale of 100 micrometers or less. GRA

N81-12851# Westinghouse Electric Corp., Mercury, Nev. Advanced Energy Systems Div.
SPENT FUEL HANDLING AND PACKAGING PROGRAM Quarterly Report, Apr. - Jun. 1980
D. C. Durrill Jul. 1980 19 p
(Contract DE-AC08-80NV-10061)
(DOE/NV-10061/3) Avail: NTIS HC A02/MF A01

Activities during the third quarter of FY 1980 included completion of encapsulation and preparation for shipment of 11 spent fuel assemblies to be tested; calorimetry of two fuel assemblies; repeat of three 1 kW fuel temperature test runs; acquisition of gas samples from fueled canisters; removal of ten RMAD shielding windows; and assembly and checkout of the canister cutter. DOE

N81-12852# Brookhaven National Lab., Upton, N. Y.
BEAM-BEAM INTERACTIONS FOR BUNCHED AND UNBUNCHED BEAMS
E. D. Courant 1980 8 p refs Presented at 11th Intern. Conf. on High Energy Accelerators, Bern, 10 Jul. 1980
(Contract DE-AC02-76CH-00016)
(BNL-28186; CONF-800764-1) Avail: NTIS HC A02/MF A01

The beam-beam interaction is analyzed in terms of Chirikov's stochasticity model. Stochastic blow-up occurs when the density of resonance regions in phase space becomes large, and Arnold diffusion is assumed to depend on the density parameter below the stochastic threshold. The relation between the density parameter and the tune shift epsilon is affected by bunching of the beam and also by variations in the strengths of several interaction regions and by beam misalignment. It is seen that bunching can reduce the tolerable epsilon by as much as an order of magnitude in proton storage rings. DOE

N81-12853# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
INTRODUCTION TO THE STUDY OF COLLISIONS BETWEEN HEAVY NUCLEI
B. F. Bayman 1980 86 p refs Presented at 3d Nuclei Phys. Workshop, Commission Nacl. de Energia Atomica, Buenos Aires, Apr., 1980
(Contract DE-AC02-79ER-10364)
(DOE/ER-10364/12) Avail: NTIS HC A05/MF A01

Current investigations concerning the collisions of nuclei governed by small de Broglie wavelengths are reviewed. The wave packets localize nuclei in regions small compared to their diameters. Cross sections are examined for potential scattering, elastic scattering, quasi-molecular states, peripheral particle transfer reactions, fusion, and deep inelastic collisions. Theories of fusion and deep inelastic collisions are summarized. DOE

N81-12854# Argonne National Lab., Ill.
INFORMAL WORKSHOP ON INTENSE POLARIZED ION SOURCES: A SUMMARY
P. F. Schultz, ed. 1980 20 p refs
(Contract W-31-109-eng-38)
(ANL-80-73) Avail: NTIS HC A02/MF A01

Problems in developing higher-intensity polarized proton sources are discussed. In particular, the concept of utilizing optically-pumped alkali vapor is addressed. DOE

N81-12855# Department of Energy, Washington, D. C.
PROPOSED RULEMAKING ON THE STORAGE AND DISPOSAL OF NUCLEAR WASTE. CROSS STATEMENT OF THE UNITED STATES DEPARTMENT OF ENERGY
5 Sep. 1980 298 p refs
(DOE/NE-0007-Suppl-1; PR-50/51(44FR61372)) Avail: NTIS HC A13/MF A01

The US DOE cross-statement in the matter of proposed rulemaking in the storage and disposal of nuclear wastes is presented. It is concluded that: (1) spent fuel can be disposed of in a manner that is safe and environmentally acceptable; (2) present plans for establishing geological repositories are an effective and reasonable means of disposal; (3) spent nuclear fuel from licensed facilities can be stored in a safe and environmentally acceptable manner on-site or off-site until disposal facilities are ready; (4) sufficient additional storage capacity for spent fuel will be established; and (5) the disposal and interim storage systems for spent nuclear fuel will be integrated into an acceptable operating system. It is recommended that the commission promulgate a rule providing that the safety and environmental implications of spent nuclear fuel remaining on site after the anticipated expiration of the facility licenses involved need not be considered in individual facility licensing proceedings. DOE

N81-12856# Department of Energy, Washington, D. C.
NEUTRAL BEAM DEVELOPMENT PLAN
H. S. Staten, comp. 1980 32 p refs
(DOE/ER-0075) Avail: NTIS HC A03/MF A01

The national plan is presented for developing advanced injection systems for use on upgrades of existing experiments, and use on future facilities such as the Engineering Test Facility, to be built in the late 1980's or early 90's where power production from magnetic fusion will move closer to a reality. Not only must higher power and longer pulse length systems be developed, but they must operate reliably; they must be a tool for the experimenter, not the experiment itself. Neutral beam systems handle large amounts of energy and as such, they often are as complicated as the plasma physics experiment itself. This presents a significant challenge to the neutral beam developer. DOE

N81-12857# Naval Research Lab., Washington, D. C.
VECTOR-POTENTIAL FLOW IN RELATIVISTIC BEAM DIODES
D. P. Bacon, S. A. Goldstein, R. Lee, and G. Cooperstein 5 Sep. 1980 38 p refs
(Contract DE-AI01-77DP-40042)
(NRL-MR-4326) Avail: NTIS HC A03/MF A01

Analytic theory, numerical simulations, and experiments indicate that a combination of a bias current pinch and an ion induced pinch may allow the efficient pinching of electron beams generated in large aspect ratio diodes. In the new diode geometry, electrons flow radially inward along vector potential field lines which lie close to the anode. As these electrons do not touch the anode, there is no plasma formation and consequent loss of energy to accelerated ions. Entering a region close to the axis in which an anode plasma does exit, these electrons undergo an ion induced pinch to still smaller radii. Since the bulk of the flow occurs along vector potential field lines, we have coined this new diode the Paravector potential diode. DOE

N81-12858# Oak Ridge National Lab., Tenn. Chemical Technology Div.
STATE-OF-THE-ART REPORT ON LOW-LEVEL RADIOACTIVE WASTE TREATMENT
A. H. Kibbey and H. W. Godbee Sep. 1980 155 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7427) Avail: NTIS HC A08/MF A01

An attempt is made to identify the main sources of low-level radioactive wastes that are generated in the United States. To place the waste problem in perspective, rough estimates are given of the annual amounts of each generic type of waste that is generated. Most of the wet solid wastes arise from the cleanup of gaseous and liquid radioactive streams prior to discharge or recycle. The treatment of the process streams and the secondary wet solid wastes thus generated is described for each type of government or fuel cycle installation. Similarly, the institutional wet wastes are also described. The dry wastes from all sources have similar physical and chemical characteristics in that they can be classified as compactible, noncompactible, combustible, noncombustible, or combinations thereof. The various treatment options for concentrated or solid wet wastes and for dry wastes are discussed. The treatment of radioactive medical and bioresearch wastes is described. Recovery of waste metals and treatment of hazardous contaminated wastes are discussed briefly. DOE

N81-12859# California Univ., Berkeley. Lawrence Berkeley Lab. Nuclear Science Div.
TWO-PARTICLE CORRELATIONS IN NUCLEAR COLLISIONS
Isaq Tanihata (Tokyo Univ., Japan) Jul. 1980 15 p refs

Presented at the INS Kukuchi Summer School on Nucl. Phys. at High Energies, Fuji-Yoshida, Japan, 1-4 Jul. 1980
(Contract W-7405-eng-48)
(LBL-11320) Avail: NTIS HC A02/MF A01

Two particle correlations in proton nucleus and nucleus nucleus collisions were measured with beams of 800 MeV/A at the Berkeley Bevalac to study the reaction mechanism in more detail. Results were obtained that give information about the mean free path of protons in the nucleus, the contribution of the single knock out process in the collisions between equal size nuclei, and the nuclear shadowing effect in collisions with a heavy target nucleus. DOE

N81-12860# Brookhaven National Lab., Upton, N. Y. Technical Support Organization.
A LASER SURVEILLANCE SYSTEM FOR SPENT FUEL
M. S. Fiarman and A. M. Bieber, Jr. 1980 13 p refs
(Contract DE-AC02-76CH-00016)
(BNL-28054; CONF-800655-29) Avail: NTIS HC A02/MF A01

A laser surveillance system for spent fuels was designed and constructed and was used with a simulated BWR assembly. The reflected signal from the zircaloy rods depends on the position of the assembly, but in all cases is easily discernible from the reference scan of background with no assembly. Author

N81-12861# Brookhaven National Lab., Upton, N. Y. Dept. of Nuclear Energy.
THE APEX ACCELERATOR CYCLE FOR TRANSMUTATION OF LONG-LIVED FISSION WASTES
J. Powell, M. Steinberg, H. Takahashi, P. Grand, T. Botts, and H. J. C. Kouts 1980 30 p refs Presented at the Intern. Conf. on Nucl. Wastes Transmutation, Austin, Tex., Jul. 1980
(BNL-28282; CONF-800743-1) Avail: NTIS HC A03/MF A01

The accelerator fuel enricher and fission product exterminator (APEX) approach to the transmutation of fission wastes is described. Using an accelerator-driven neutron source, fissile fuel can be bred in situ (e.g., 238 U is converted to 239 Pu by neutron absorption) in reactor fuel assemblies. The rejuvenated fuel is reused in reactors. After fuel reprocessing and partitioning, stable and low hazard fission products are disposed of. Transuranics are returned to the nuclear fuel cycle, along with the remaining fissile and fertile fuel. Selected fission products (e.g., 90Sr and 137Cs) can either be recycled along with the nuclear fuel (APEX-1) or transmuted (APEX-2). The necessary accelerator and target technologies are relatively well developed and can be applied in a few years. One accelerator fuel enricher/transmutor can service a substantial number of reactors (e.g., 3 to 10), depending on type of target and nature of fuel cycle. M.G.

74 OPTICS

Includes light phenomena.

N81-12862*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FIBER OPTIC CROSSBAR SWITCH FOR AUTOMATICALLY PATCHING OPTICAL SIGNALS Patent Application
Charles H. Bell, inventor (to NASA) Filed 27 May 1980 16 p
(NASA-Case-KSC-11104-1; US-Patent-Appl-SN-153245) Avail: NTIS HC A02/MF A01 CSCL 20F

A system for automatically optically switching fiber optic data signals between a plurality of input optical fibers and selective ones of a plurality of output fibers is described. The system includes optical detectors which are connected to each of the input fibers for converting the optic data signals appearing at the respective input fibers to an RF signal. A plurality of RF to optical signal converters are arranged in rows and columns. The output of each of the optical detectors are each applied to a respective row of optical signal converters for being converted back to an optical signal when the particular optical signal converter is selectively activated by a DC voltage. These optical signals are then applied via optical fibers to optical detectors which convert the optical signal back to an RF signal which is used for driving the ILDs. The ILDs, in turn, convert the RF signals back to optical signals without any mechanical switching either of the optical signals or the RF signals. NASA

N81-12863*# Digital Communications Corp., Gaithersburg, Md.
FEASIBILITY STUDY OF AN INTEGRATED OPTIC SWITCHING CENTER Final Report
May 1979 148 p
(Contract NAS5-24449)
(NASA-CR-160042; DDC-823-279-FR-00-357) Avail: NTIS HC A07/MF A01 CSCL 20F

The design of a high data rate switching center for a satellite tracking station is discussed. The feasibility of a switching network using an integrated switching matrix is assessed. The preferred integrated optical switching scheme was found to be an electro-optic Bragg diffraction switch. To ascertain the advantages of the integrated optics switching center, its properties are compared to those of opto-electronic and to electronics switching networks. M.G.

N81-12864*# Galileo Electro-Optics Corp., Sturbridge, Mass.
FIBER OPTIC COMBINER AND DUPLICATOR
30 Nov. 1979 38 p refs
(Contract NAS5-23250)
(NASA-CR-160044) Avail: NTIS HC A03/MF A01 CSCL 20F

The investigation of the possible development of two optical devices, one to take two images as inputs and to present their arithmetic sum as a single output, the other to take one image as input and present two identical images as outputs is described. Significant engineering time was invested in establishing precision fiber optics drawing capabilities, real time monitoring of the fiber size and exact measuring of fiber optics ribbons. Various assembly procedures and tooling designs were investigated and prototype models were built and evaluated that established technical assurance that the device was feasible and could be fabricated. Although the interleaver specification in its entirety was not achieved, the techniques developed in the course of the program improved the quality of images transmitted by fiber optic arrays by at least an order of magnitude. These techniques are already being applied to the manufacture of precise fiber optic components. L.F.M.

N81-12865# Army Missile Command, Redstone Arsenal, Ala.
MICOM PROGRAM IN OPTICAL BISTABILITY
Charles M. Bowden and David W. Howgate Jun. 1980 15 p refs
(AD-A090366) Avail: NTIS HC A02/MF A01 CSCL 20/6

Some years ago, a number of people independently suggested the use of the saturable absorber to induce optical bistability (hereafter referred to as OB). The phenomenon was demonstrated and studied recently by Gibbs, McCall and Venkatesan who used a cw dye laser to excite atoms of sodium vapor in a cell between the plates of a Fabry Perot interferometer. Under certain experimental and material conditions, they observed a nonlinear dependency of the transmitted field as a function of the dye-laser input which exhibited hysteresis, differential gain, and bistable behavior. Interest in OB from the practical applications standpoint stems from obvious device applications as the optical analog of the transistor, optical clipper or limiter and digital optical memory element. The recent demonstration of the phenomenon has generated considerable interest from the fundamental point of view as a clear example of spontaneous ordering in an open, stationary system of matter interacting with light. This has led to a surge of recent theoretical activity. GRA

N81-12866# Utah Univ., Salt Lake City. Dept. of Chemistry.
BRILLOUIN SCATTERING STUDIES OF THE EFFECT OF ORIENTATION ON THE MECHANICALLY DEFORMED POLY-(ETHYLENE TEREPTHALATE)
David B. Cavanaugh and Chin Hsien Wang 30 Jul. 1980 24 p refs
(Contract N00014-79-C-0507)
(AD-A090589) Avail: NTIS HC A02/MF A01 CSCL 11/9

Brillouin light scattering is used to study the internal structure of oriented films of poly(ethylene-terepthalate). Brillouin scattering was observed to occur independently from the crystalline and amorphous regions in the superstructure. Sound velocity data from these two regions are used to draw directional maps of

the sound velocity in the films and are shown to give structural information for both regions. The results are discussed qualitatively and correlated with a recently proposed model. The amorphous phase orientation distribution functions are calculated for a series of draw ratios using the hypersonic velocities. The results are in agreement with published results which were obtained by a different method. GRA

N81-12867# Harry Diamond Labs., Adelphi, Md.
THE EXTENSION OF (Hg, Cd)Te DETECTOR TECHNOLOGY TO THE NEAR MILLIMETER SPECTRAL REGION
Bruce A. Weber and Stanley M. Kulpa Jun. 1980 10 p refs
(AD-A090449) Avail: NTIS HC A02/MF A01 CSCL 17/5

This paper discusses the development of the first hot-electron photo-conductive detector using crystals of the alloy semiconductor mercury-cadmium-telluride, Hg sub 1-x, Cdxte. When the crystals were irradiated with near-millimeter wave (NMMW) radiation, sensitivity was observed throughout the 100 to 1000 GHz spectral region. These results are significant because they suggest that the extensive (Hg,Cd)Te technology base developed for FLIR systems may also be exploited for the development of NMMW sensors. Such exploitation might lead to the development of hybrid NMMW/IR sensors using only one detection element. The need for semiconductors with a variable bandgap has led to the study of various ternary compounds. Among these, (Hg,Cd)te has been developed for use in detectors and lasers in the 8 to 14 micrometer spectral region. Operation in the hot-electron photoconductive mode extends the use of this material to the NMMW spectral region. Applications include Ir and NMMW heterodyne receivers for all-weather surveillance and tracking systems, NMMW broadband video receivers for spectroscopic studies of materials and atmospheric gases, and submillimeter heterodyne receivers for fusion plasma diagnostics. GRA

N81-12868# Harry Diamond Labs., Adelphi, Md.
NUCLEAR RADIATION EFFECTS IN FIBER-OPTIC WAVE-GUIDES
Stewart Share and John Wasilik Jun. 1980 12 p refs
(AD-A090439) Avail: NTIS HC A02/MF A01 CSCL 20/6

The purpose of this paper is to identify an optical waveguide which has a good chance for meeting the Army's requirements for a radiation-hardened fiber-optic communication system. To accomplish this goal we have carried out an experimental research program on a wide variety of commercially available optical waveguides and research prototypes. Glass-clad, high-silica fibers, suitable for long-length telecommunications applications, were studied. GRA

N81-12869# Rockwell International Corp., Anaheim, Calif.
ADVANCED IR IMAGING SEEKER PROGRAM
R. A. Aguiera 20 May 1980 8 p refs Presented at AIAA Strategic/Tactical Systems and Space Sci. Meeting, San Diego, Calif., 8-10 Sep. 1980
(Contract DAAK40-77-C-0129; DARPA Order 3239)
(AD-A090642) Avail: NTIS HC A02/MF A01 CSCL 17/7

An advanced IR Imaging Seeker System was developed which is compatible with the Hellfire Missile System mission. A technical overview of this program and current status is presented. The IR imaging seeker was tested during late 1979 and early 1980. This seeker utilizies a 1024 element InAsSb/silicon hybrid focal plane array (FPA) operating at 77 degrees K and IR-sensitive in the 2.4-4.0 micrometer wavelength region. A multimode tracker provides improved tracking capability for operation against targets in a high clutter background. GRA

N81-12870# Army Materials and Mechanics Research Center, Watertown, Mass.
TRANSPARENT, POLYCRYSTALLINE CUBIC ALUMINUM OXIDE
James W. McCauley and Normand D. Corbin Jun. 1980 15 p refs
(AD-A090418) Avail: NTIS HC A02/MF A01 CSCL 20/2

The means used to observe or sense the enemy have progressed from actual eye-to-eye observation to extensive use of radar and sonar, and now include using infrared (IR) signals. At the same time, various forms of armor, from face shields to sophisticated electromagnetic (EM) windows and domes (radomes, IR domes), have been developed to transmit signals and also to protect the sensing mechanisms - either the human eye or intricate electronic devices. Countermeasures such as smoke and radar-jamming systems have concurrently evolved to defeat the various sensing devices. In order to minimize the effectiveness of dedicated (single-mode) or even broadband countermeasure tactics, sensing devices of the future, therefore, must be able to simultaneously function over a large region of the EM spectrum, including visible light, IR, microwave and millimeter wave radars. It is imperative, then, that new materials must be developed to transmit a wide range of the EM spectrum, while at the same time protecting the fragile sensing equipment in wide-ranging types of severe battlefield environments. GRA

N81-12871# California Univ., Berkeley. Lawrence Berkeley Lab.
PHOTOEMISSION FROM SOLIDS: THE TRANSITION FROM SOLID-STATE TO ATOMIC PHYSICS
David A. Shirley Aug. 1980 11 p refs Presented at the Intern. Conf. on X-ray Processes and Inner-shell Ionization, Stirling, England, 25 Aug. 1980
(LBL-11276; CONF-800859-2) Avail: NTIS HC A02/MF A01

As the photon energy is increased, photoemission from solids undergoes a slow transition from solid state to atomic behavior. However, throughout the energy range h nu = 10 to 1000 eV or higher both types of phenomena are present. Thus angle resolved photoemission can only be understood quantitatively if each experimenter recognizes the presence of band structure, photoelectron diffraction, and photoelectron asymmetry effects. The quest for this understanding will build some interesting bridges between solid state and atomic physics and should also yield important new insights about the phenomena associated with photoemission. DOE

N81-12872# Los Alames Scientific Lab., N. Mex. Theoretical Div.
APPLICATION OF MOOT TO SCATTERING OF ELASTIC WAVES FROM COMPOUND INCLUSIONS
William M. Visscher 1980 6 p refs Presented at the DARPA/AFML Rev. of Progr. in Quant. NDE Conf., La Jolla, Calif., 14-17 Jul. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2039; CONF-800767-2) Avail: NTIS HC A02/MF A01

A convergent T-matrix scheme, MOOT (method of optimal truncation), was used to calculate elastic wave scattering from compound inclusions, i.e., inclusions which themselves contain flaws: inclusions, voids, or cracks. The general equations were derived, and they were solved for a particular axially-symmetric case, a cracked spherical inclusion immersed in fluid. The crack edge was a circle on the equatorial plane; the crack could extend either inward to the center or outward to the surface of the sphere. Numerical results are given for scattering of acoustic waves from cracked spheres of various materials. DOE

N81-12873# Oregon State Univ., Corvallis.
STUDY OF ROUGHNESS-INDUCED DIFFUSE AND SPECULAR REFLECTANCE AT SILVER-AIR AND SILVER-LIQUID INTERFACES Final Report, 1 Jul. 1979 - 31 Aug. 1980
S. O. Sari Jul. 1980 47 p refs
(Contract DE-AS02-77ER-04381)
(COO-4381-10) Avail: NTIS HC A03/MF A01

Surface plasma wave absorption and roghness induced optical scattering from an interface of silver and air were investigated. The position of the surface plasma resonance minimum in reflectivity for a stochastically roughened metal silver surface was studied as a function of a number of distinct roughness perturbations. In the case of a transparent liquid-silver boundary the frequency red shift of the resonance minimum was determined and the location of the surface plasmon dip for various liquids is shown to agree well with a simple roughness theory. The additional interfacial properties due to the formation of a thin inhomogeneous oxide layer occurring either spontaneously or due to application of a small interfacial electrical potential are more complex. The optical constants of the interlayer were determined

from differential specular reflectance measurements at the boundary. DOE

N81-12874# Chicago Univ., Ill. Enrico Fermi Inst.
FUNDAMENTALS AND TECHNIQUES OF NONIMAGING OPTICS FOR SOLAR ENERGY CONCENTRATION Technical Progress Report
Roland Winston and Joseph J. OGallaher 15 Sep. 1980 50 p refs
(Contract DE-AC02-80ER-10575)
(DOE/ER-10575/1) Avail: NTIS HC A03/MF A01

Recent progress in basic research into the theoretical understanding of nonimaging optical systems and their application to the design of practical solar concentration was reviewed. Work was done to extend the previously developed geometrical vector flux formalism with the goal of applying it to the analysis of nonideal concentrators. Both phase space and vector flux representation for traditional concentrators were generated. Understanding of the thermodynamically derived relationship between concentration and cavity effects led to the design of new lossless and low loss concentrators for absorbers with gaps. Quantitative measurements of the response of real collector systems and the distribution of diffuse insolation shows that in most cases performance exceeds predictions in solar applications. These developments led to improved nonimaging solar concentrator designs and applications. DOE

N81-12875# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
SURFACE NONLINEAR OPTICS
Y. R. Shen, C. K. Chen, and A. R. B. deCastro 1980 9 p refs Presented a the Sergio Porto Memorial Symp. on Lasers and Applications, Rio de Janeiro, 29 Jun. - 3 Jul. 1980 Prepared in cooperation with California Univ., Berkeley
(LBL-11252; CONF-8006113-1) Avail: NTIS HC A02/MF A01

Surface electromagnetic waves are waves propagating along the interface of two media. Their existence was predicted by Sommerfield in 1909. In recent years, interesting applications were found in the study of overlays and molecular adsorption on surfaces, in probing of phase transitions, and in measurements of refractive indices. In the laboratory, the nonlinear interaction of surface electromagnetic waves were studied. The preliminary results of this recent venture in this area are presented. DOE

N81-12876# Brookhaven National Lab., Upton, N. Y.
OPTICAL FIBERS AND AVALANCHE PHOTODIODES FOR SCINTILLATOR COUNTERS
S. R. Borenstein, R. B. Palmer, and R. C. Strand 23 Jul. 1980 25 p refs Presented at Intern. Conf. on Experimentation at LEP, Uppsala, N.J. 16-20 Jun. 1980
(BNL-28195) Avail: NTIS HC A02/MF A01

Optical fibers and avalanche photodiodes for scintillator counters are discussed. An avalanche photodiode with small size and immunity to magnetic fields to be proven as a photodetector for the fibers. S.F.

N81-12877# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.
DYNAMIC TEST OF A MECHANICAL MODEL USING A COHERENT LIGHT VIBRATION SENSOR
F. Parmigiani Mar. 1979 29 p refs
(CISE-N-192) Avail: NTIS HC A03/MF A01

The dynamic behavior of a cooling tower model excited by a random force is obtained using as a vibration sensor a Michelson polarizing interferometer. This technique does not alter the dynamic characteristics of the structure and it tests the vibrations on a very small area (about 1 sq mm). The vibration signals detected by the interferometer are digitally analyzed, the frequency response function and the coherence function are given and the technique discussed. Author (ESA)

N81-12878# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DESCRIPTION AND UTILIZATION OF A COMPUTATION PROGRAM OF THE OPTICAL RADIATION TRANSMITTED, EMITTED OR DIFFUSED BY THE ATMOSPHERE FOR SATELLITE OBSERVATION
Anne-Marie Bouchardy and Jean-Claude Fontanella 1980 45 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-665)
(ONERA-NT-1980-3; ISSN-0078-3781) Avail: NTIS HC A03/MF A01

A computer program RAVIR (radiation in the atmosphere in the visible and the infrared) is described for computation of the radiation received by an observation satellite, within a spectral range from 0.3 to 25 microns. The algorithms used for the calculation of the atmospheric transmittance are largely inspired by the American computer code LOWTRAN. Program RAVIR also computes the thermal atmospheric radiance, and the radiance due to the scattered solar radiation. The program is not listed. Author (ESA)

N81-12879# National Technical Information Service, Springfield, Va.
NIGHT VISION DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1980
Guy E. Habercom, Jr. Aug. 1980 332 p Supersedes NTIS/PS-79/0999; NTIS/PS-78/0933
(PB80-814957; NTIS/PS-79/0999; NTIS/PS-78/0933) Avail: NTIS HC $30.00/MF $30.00 CSCL 17E

This bibliography contains 323 citations in which various types of night vision devices are investigated. Most were developed for military applications but they can readily be adapted for civil usage, as for example, law enforcement. Abstracts on display screens, equipment design and effectiveness, electronic components, spurious noise reduction, and test methods are cited. GRA

N81-12880# National Technical Information Service, Springfield, Va.
NIGHT VISION DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1980
Guy E. Habercom, Jr. Aug. 1980 91 p Supersedes NTIS/PS-79/1000; NTIS/PS-78/0938
(PB80-814932; NTIS/PS-79/1000; NTIS/PS-78/0938) Avail: NTIS HC $30.00/MF $30.00 CSCL 17E

Various types of night vision devices are investigated in these abstracts of reports gathered in a worldwide literature survey of professional and industrial publications. Display systems, equipment design and effectiveness, electronic components, spurious noise reduction, and test methods are among the items researched. This updated bibliography contains 86 citations, 7 of which are new entries to the previous edition. GRA

N81-13007# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
THE USE OF OPTICAL TECHNIQUES IN THE INTERPRETATION OF HEAT TRANSFER MEASUREMENTS
J. M. Owen and J. R. Pincombe *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-12881# Ben Gurion Univ. of the Negev, Beersheva (Israel). Dept. of Mechanical Engineering.
EFFECT OF WETTING LAYER AND VOID FRACTION NONUNIFORMITY ON THE CHARACTERISTICS OF A TWO-PHASE LIQUID-METAL MHD GENERATOR
Herman Branover 29 Nov. 1979 30 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Energy in Nov. - Dec. 1980
(Grant N00014-77-G-0034; NR Proj. 099-407)
(LOG-E379) Avail: NTIS HC A03/MF A01

An analytical model which makes it possible to estimate the effect of a liquid wetting layer on the nonconducting walls of a channel and of nonuniformity of the void fraction distribution

on the generator performance is postulated. The question of the effect of this layer in the case of uniform void fraction distribution in the flow core for moderate values of the Hartmann number is examined. An analytic solution for high Hartmann numbers concluded that this layer did not have a significant effect on the efficiency of large generators. The presence of the wetting layer leads to a significant increase in the required pressure drop, and to a significant reduction in power output when the pressure drop is specified. S.F.

N81-12882*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTROSTATIC HEAT FLUX INSTABILITIES
Philip J. Morrison and James A. Ionson Sep. 1980 39 p refs
(NASA-TM-82008) Avail: NTIS HC A03/MF A01 CSCL 20I

The electrostatic cyclotron and ion acoustic instabilities in a plasma driven by a combined heat flux and current were investigated. The minimum critical heat conduction speed (above which the plasma is unstable) is given as a function of the ratio of electron to ion temperatures. Author

N81-12883*# Science Applications, Inc., La Jolla, Calif. Lab. for Applied Plasma Studies.
GAS RELEASE AND CONDUCTIVITY MODIFICATION STUDIES Final Report
Lewis M. Linson and David C. Baxter May 1979 132 p refs (Contract NAS5-24121)
(NASA-CR-160047; SAI-023-79-713-LJ) Avail: NTIS HC A07/MF A01 CSCL 20I

The behavior of gas clouds produced by releases from orbital velocity in either a point release or venting mode is described by the modification of snowplow equations valid in an intermediate altitude regime. Quantitative estimates are produced for the time dependence of the radius of the cloud, the average internal energy, the translational velocity, and the distance traveled. The dependence of these quantities on the assumed density profile, the internal energy of the gas, and the ratio of specific heats is examined. The new feature is the inclusion of the effect of the large orbital velocity. The resulting gas cloud models are used to calculate the characteristics of the field line integrated Pedersen conductivity enhancements that would be produced by the release of barium thermite at orbital velocity in either the point release or venting modes as a function of release altitude and chemical payload weight. Author

N81-12884# Nagoya Univ. (Japan).
SPINNING PLASMA RING STABLE TO TILTING MODE
Akihiro Mohri Sep. 1980 9 p refs
(IPPJ-478) Avail: NTIS HC A02/MF A01

The tilting instability of a current carrying plasma ring bedded in an external magnetic field for equilibrium is stabilized by spinning the ring about its major axis at the angular velocity above a critical value. This value is estimated using a rigid rotor model. Author

N81-12885# Nagoya Univ. (Japan).
TWO DIMENSIONAL BEHAVIOR OF SOLITONS IN A LOW-B PLASMA WITH CONVECTIVE MOTION
M. Makino, T. Kaminura, and T. Sato Sep. 1980 26 p refs
(IPPJ-480) Avail: NTIS HC A03/MF A01

The initial value problem of the Hasegawa-Mima (HM) equations, which describes the propagation of drift waves in a low beta magnetized plasma, was numerically studied. Solitons were formed from an initial sinusoidal wave. For a wide range of initial conditions, the number of solitons and the recurrence time agreed well with those obtained from the Korteweg-devries equation reduced from the HM equation. As a result of nonlinear interactions among different solitons, their peak positions shifted in the direction normal to the zeroth order convective motion in a regular but different fashion. When starting from a sinusoidal wave, the peaks of the generated soliton train line up on a line at an angle with respect to the convective direction. Two dimensional collisions of different solitons were examined. Author

N81-12886 Nagoya Univ. (Japan).
ANOMALOUS DECELERATION OF LIGHT ION BEAM IN PLASMA OF INERTIAL CONFINEMENT FUSION
T. Abe and K. Niu Sep. 1980 18 p refs
(IPPJ-479) Avail: NTIS HC A02/MF A01

The ion beam propagation in inertial confinement fusion by light ion beam was analyzed. The anomalous deceleration of the beam ion occurs, when the beam including the electron interacts with the background plasma with a comparable number density. This deceleration is caused by the two stream instability between the beam and the background plasma electrons and then becomes maximum when each density is equivalent. The anomalous deceleration rate of the beam ion was computed by using the quasilinear theory. The anomalous deceleration which the beam ion accepts from the background plasma is equivalent to the classical one from the background plasma with solid density. Author

N81-12887# Naval Research Lab., Washington, D. C. Lab. for Computational Physics.
THE EFFECTS OF ELECTRON-NEUTRAL COLLISIONS ON THE INTENSITY OF PLASMA LINES
Alice L. Newman (JAYCOR, Alexandria, Va.) and Elaine S. Oran 17 Oct. 1980 17 p refs
(AD-A090749; NRL-MR-4334) Avail: NTIS HC A02/MF A01 CSCL 04/1

In the Earth's ionosphere the presence of nonthermal electrons causes enhancements of the electron plasma line resonance observed by incoherent backscatter radar. This paper extends previous calculations of the plasma intensity by including resonance broadening due to electron neutral collisions. A BGK collision term is included in the derivation of the electron spectral density function obtained from Fluctuation Dissipation theory. Assuming the nonthermal electron distribution is a small perturbation on a Maxwellian distribution of background electrons, the expression describing the signal intensity for a plasma line reduces to the form obtained previously when only electron-ion collisions were included. Results of this extended model are compared to recent measurements made with the Chatanika radar. GRA

N81-12888# California Univ., Los Angeles. Plasma Physics Group.
EFFECT OF A dc ELECTRIC FIELD ON THE TRAPPING DYNAMICS OF A COLD ELECTRON BEAM
G. J. Morales Oct. 1979 67 p refs
(Contract N00014-75-C-0476)
(AD-A090810; PPG-439) Avail: NTIS HC A04/MF A01 CSCL 20/9

This study considers the self-consistent modification of the trapping dynamics of a low density cold electron beam due to the external application of a dc electric field. For dc fields smaller than the peak amplitude of the saturated beam-plasma instability, the beam energy remains clamped while the wave amplitude grows secularly. Large travelling potential wells appear and create strongly focused charge clumps. By considering the role of wave dissipation an exact dynamic BGK (Bernstein-Green-Kruskal) equilibrium is found analytically. It consists of a singular charge clump which propagates through the medium at constant velocity even though a dc field is present. The numerical study of the basic equations shows that the system evolves asymptotically to this singular state. A variety of experimentally relevant phenomena associated with the trapping dynamics is investigated, including the stability of the dynamic nonlinear equilibrium to sideband growth. GRA

N81-12889# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
INTERFEROMETRIC MEASUREMENT OF SMALL REFRACTION ANGLES
J. A. Stamper 15 Oct. 1980 10 p refs
(AD-A090594; NRL-MR-4353) Avail: NTIS HC A02/MF A01 CSCL 20/6

Radial and axial refraction angles are separately measured for rays passing through an azimuthally symmetric medium. The fringe slopes from complementary interferograms are used in a derived expression. Shearing interferometry is used in an example. GRA

N81-12890# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
STRONGLY-LOCALIZED BALLOONING MODES IN A TANDEM MIRROR
D. A. Dippolito and J. R. Myra Aug. 1980 26 p refs
(Contract DE-AC03-76ET-53057)
(SAI-254-80-493-LJ; PRI-12) Avail: NTIS HC A03/MF A01

A simple model of a tandem mirror without thermal barriers is employed to study the stability of ballooning modes which are confined to the central mirror cell. The central cell is treated as axisymmetric and long-thin with isotropic pressure, while the end plug is modeled by a stabilizing boundary condition. The scaling of beta (sub c) with the mirror ratio, R, and the connection length, L (sub c), is computed, and the sensitivity of these results to the magnetic field profile chosen is discussed. DOE

N81-12891# Oak Ridge National Lab., Tenn. Computer Sciences Div.
USING PACKAGED SOFTWARE FOR SOLVING TWO DIFFERENTIAL EQUATION PROBLEMS THAT ARISE IN PLASMA PHYSICS
P. W. Gaffney 1980 50 p refs Presented at the Conf. on Elliptic Problem Solvers, Santa Fe, N. Mex., 30 Jun. - 2 Jul. 1980
(Contract W-7405-eng-26)
(CONF-800699-4) Avail: NTIS HC A02/MF A01

Experience in using packaged numerical software for solving two related problems that arise in plasma physics is described. These problems were the solution of the reduced resistive MHD equations and the solution of the Grad-Shafranov equation. DOE

N81-12892# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
COLLISIONAL END LOSSES FROM CONVENTIONAL AND TANDEM MIRRORS
P. J. Catto and I. B. Bernstein (Yale Univ., Conn.) 1980 23 p refs
(Contract DE-AC03-76ET-53057)
(SAI-254-80-442-LJ; PRI-8) Avail: NTIS HC A02/MF A01

A simple variational procedure is employed to obtain an analytical expression for the collisional particle end loss rate in a mirror for the electrostatically confined species. The technique circumvents the need for an accurate solution for the distribution function, and yet reproduces the previous large mirror ratio, large barrier height results for the loss rate. The analytic result is also in remarkably good agreement with a numerical solution of the full linearized Fokker-Planck equation. DOE

N81-12893# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
LOWER-HYBRID-DRIFT INSTABILITY WITH AXIS ENCIRCLING IONS
J. R. Myra, P. J. Catto, and R. E. Aamodt Aug. 1980 40 p refs
(Contract DE-AC03-79ET-53057)
(SAI-254-80-477-LJ; PRI-11) Avail: NTIS HC A03/MF A01

The stability of a cylindrical plasma to electrostatic flute perturbations in the ion cyclotron to lower hybrid frequency range is considered. The analysis exploits the large growth rates of these modes to reduce the governing radial eigenvalue problem from an integral equation to a second order differential equation, but allows treatment of arbitrary ion Larmor radius to plasma radius. The fastest growing modes of the ion guiding center on axis model are shown to connect onto the lower hybrid drift modes of local slab theory. Numerical and analytical results for growth rates and most unstable mode numbers are obtained. DOE

N81-12894# Science Applications, Inc., Boulder, Colo. Plasma Research Inst.
BUMPY TORUS TRANSPORT IN THE LOW COLLISION FREQUENCY LIMIT
R. D. Hazeltine and P. J. Catto May 1980 75 p refs
(Contract DE-AC03-76ET-53057)
(SAI-254-80-347-LJ; PRI-5) Avail: NTIS HC A04/MF A01

A variational formulation of transport for a closed field line, large aspect ratio bumpy torus in the low collision frequency limit is presented. The relatively large radial excursions made by those particles with canceling magnetic and electric poloidal drifts requires generalization of previous neoclassical techniques. General expressions for the transport coefficients of both charge species are given. Explicit numerical coefficients are evaluated under certain simplifying assumptions for both the banana and nonbanana species. DOE

N81-12895# Princeton Univ., N. J. Plasma Physics Lab.
TOROIDAL PLASMA EQUILIBRIUM WITH GRAVITY
Shoichi Yoshikara Sep. 1980 22 p refs
(Contract DE-AM02-76CH-03073)
(PPPL-1704) Avail: NTIS HC A02/MF A01

Toroidal magnetic field configuration in a gravitational field is calculated both from a simple force balance and from the calculation using magnetic surfaces. The configuration is found which is positionally stable in a star. The vibrational frequency near the equilibrium point is proportional to the hydrostatic frequency of a star multiplied by the ratio (W sub B/W/sub M) (1/2) where W sub B is the magnetic field energy density, and W sub M is the material pressure at the equilibrium point. It is proposed that this frequency may account for the observed solar spot cycles. DOE

N81-12896# College of William and Mary, Williamsburg, Va.
NONLINEAR MAGNETOHYDRODYNAMICS Progress Report, 1 Jan. - 31 Dec. 1980
G. Vahala and D. Montgomery 1980 13 p refs
(Contract DE-AS05-76ET-53045)
(ORO-5260-4) Avail: NTIS HC A02/MF A01

Given only some global information, equilibrium profiles were statistically determined. Higher order growth rate calculations were made using the Rayleigh-Schroedinger approach. L.F.M.

N81-12897# Wisconsin Univ., Madison.
STABILITY ANALYSIS OF CYLINDRICAL VLASOV EQUILIBRIA Ph.D. Thesis
Robert W. Short 1979 214 p refs
(COO-2387-113) Avail: NTIS HC A10/MF A01

A general method of stability analysis is described which may be applied to a large class of problems, namely those described dynamically by the Vlasov equation, and geometrically by cylindrical symmetry. First, the simple case of the Vlasov-Poisson (electrostatic) equations is presented, and the results are applied to a calculation of the lower hybrid drift instability in a plasma with a rigid rotor distribution function. Then the method is extended to the full Vlasov-Maxwell (electromagnetic) equations, and the results are applied to a calculation of the instability of the extraordinary electromagnetic mode in a relativistic E-layer interacting with a background plasma. L.F.M.

N81-12898# Argonne National Lab., Ill.
MHD HEAT AND SEED RECOVERY TECHNOLOGY PROJECT Quarterly Report, Oct. - Dec. 1979
Michael Petrick and Terry R. Johnson Aug. 1980 54 p refs
(Contract W-31-109-eng-38)
(ANL/MHD-80-1; QR-8) Avail: NTIS HC A04/MF A01

Heat and Seed Recovery Technology Project is discussed, including NOx behavior in the radiant boiler and secondary combustor, radiant boiler design to meet the multiple requirements of steam generation, NOx decomposition, and seed-slag separating, effects of solid or liquid seed deposits on heat transfer and gas flow in the steam and air heaters, formation, growth, and deposition of seed-slag particles, character of the combustion gas effluents, and the corrosion and erosion of ceramic and metallic materials of construction. S.F.

N81-12899# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.
WAVE PROPAGATION IN A TEMPERATE PLASMA HAVING n IONS SPECIES [WELLENAUSBREITUNG IN EINEM TEMPERIERTEN PLASMA MIT n IONENSORTEN]
G. Janzen 1979 113 p refs In GERMAN; ENGLISH summary
(IPF-78-7) Avail: NTIS HC A06/MF A01

Plane wave propagation in temperate plasmas consisting of n ion species is calculated. Analytical results are given for collisionless n species plasmas of arbitrary composition. Refractive index and damping are calculated numerically for plasmas including

collisions of any kind and at arbitrary angles of propagation. Results show that at angles other than 90 deg to the externally applied magnetic field there are two simultaneously propagating waves showing resonances at the cyclotron frequencies of the ions involved and being separated by n-1 ion-ion-hybrid cutoffs. Strong particle coupling through high ion collision rates reduces the n cyclotron resonances to new combined, mass weighted, and frequency shifted cyclotron resonance frequencies. In the ion cyclotron frequency range, one wave propagates at right angles to the external magnetic field showing n-1 ion-ion-hybrid resonances and n-1 hybrid cutoffs. The hybrid resonance frequencies lie close to the cyclotron frequencies of the minority ions. In the neighborhood of the resonances, the ion collisions affect damping of the wave considerably more than electron collisions. Author (ESA)

N81-12900# Stuttgart Univ. (West Germany). Inst. fuer Plasmaforschung.

ABSORPTION OF MAGNETOACOUSTIC WAVES IN A HIGH BETA PLASMA Final Report

F. Moser, E. Raeuchle, E. Schneider, and P. G. Schueller 1979 19 p refs In GERMAN; ENGLISH summary Submitted for publication

(IPF-79-3) Avail: NTIS HC A02/MF A01

The radial propagation and absorption of magnetoacoustic waves in a radially inhomogeneous, high beta plasma column of a theta pinch is investigated both theoretically and experimentally. It is shown that viscosity is the dominant dissipative mechanism. Power absorption up to 10 MW is obtained which corresponds to an average heating rate of 5 eV/microsec per particle. Author (ESA)

N81-12901# Centro Informazioni Studi Esperienze, Milan (Italy). Documentation Service.

A COMPUTER PROGRAM FOR LINE PROFILE SIMULATIONS OF A LASER PRODUCED PLASMA

A. M. Malvezzi Oct. 1978 39 p refs

(Contract CNR-74-00831.11)

(CISE-N-187) Avail: NTIS HC A03/MF A01

A numerical code is described for evaluating the intensity and spectral profile of the resonance lines emitted by focusing laser radiation onto plane targets. The main mechanisms responsible for natural lineshape modifications are recognized in Stark and Doppler broadening plasma, streaming motion, and optical opacity. The numerical problems connected with the profile evaluation (i.e., solution of the radiative transfer equation with locally variable coefficients) are described. An example is given of how the program works for a particular set of input parameters. Author (ESA)

N81-12902# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).

A REACTOR STUDY ON A BELT-SHAPED SCREW PINCH

M. Bustraan, B. Brandt, G. C. Damstra, W. M. P. Franken, J. A. Hoekzema, Klein H. J. Nibbelink, H. T. Klippel, W. Schuurman, J. H. Veringa, and K. A. Verschuur Oct. 1979 51 p refs Sponsored by Nederlands Organization voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and EURATOM Prepared in cooperation with Netherlands Energy Research Foundation, Petten and Kema (N.V.), Arnhem, Netherlands

(Rept-73-76; ECN-77) Avail: NTIS HC A04/MF A01

A previous study on a screw pinch reactor with circular cross section was extended to a belt configuration which raises beta to 0.5. Attention was paid to modular construction, non uniform distribution of wall loading, thermohydraulics, the design of and the losses in the coil systems, and energy storage and electric transmission systems. A potential use of the first wall of the blanket as part of the implosion coil system is suggested. A conceptual design of a reactor with a cost estimate is given. Numerical results are given of parameter variations around the values for the reference reactor. The belt screw pinch reactor with resistive coils turns out to be uneconomical, because of ist low net efficiency and its high capital costs. The application of superconducting coils to reduce the ohmic losses turns out to be a nonviable alternative. A more promising way to improve the energy balance seems to be using fuel injection during the burn. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N81-12903# Naval Research Lab., Washington, D. C. Material Science and Component Technology Directorate.

THE USE OF ION IMPLANTATION FOR MATERIALS PROCESSING Semiannual Progress Report, 1 Oct. 1979 - 31 Mar. 1980

F. A. Smidt 6 Oct. 1980 135 p refs

(ZF61544007; WF41401000)

(AD-A090714; NRL-MR-4341) Avail: NTIS HC A07/MF A01 CSCL 13/8

An interdisciplinary program on the use of ion implantation for materials processing is being conducted at NRL. This report describes the important factors in ion implantation science and technology and reports progress in the use of ion implantation to modify friction, wear, fatigue, corrosion, and optical properties of materials. GRA

N81-12904# Chicago Univ., Ill. Dept. of Chemistry.

ADSORPTION OF OXYGEN ON THE TUNGSTEN (110) PLANE AT LOW TEMPERATURES. SPECTROSCOPIC MEASUREMENTS

R. Opila and R. Gomer 6 Oct. 1980 15 p refs Submitted for publication Sponsored in part by NSF

(Contract N00014-77-C-0018)

(AD-A090603; TR-4) Avail: NTIS HC A02/MF A01 CSCL 07/4

The adsorption of oxygen on the W(110) plane was carried out at 26 K and investigated by means of ultraviolet and X-ray photoelectron spectroscopy. It was found that atomic oxygen is adsorbed first to essentially saturation coverage (O/W-0.6) before adsorption of molecular oxygen occurs. The spectrum of the latter is very similar to that of gas phase O2 but the shift to weaker binding energies is greater for the 1st level than for the valence orbitals. GRA

N81-12905# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

LARGE HIGH QUALITY SINGLE CRYSTAL ALUMINUM PHOSPHATE FOR ACOUSTIC WAVE DEVICES

Thomas R. Aucoin, Robert O. Savage, Melvin J. Wade, John G. Gualtieri, and Abraham Schwartz Jun. 1980 13 p refs

(AD-A090359) Avail: NTIS HC A02/MF A01 CSCL 20/2

Recently there has been considerable interest in the potential for using single crystal alpha AlPO4 in a variety of acoustic wave applications. This interest was prompted by the possibility of obtaining simultaneously in one material, the properties of temperature stability, low acoustic loss, and high piezoelectric coupling. The poor quality and general lack of large alpha AlPO4 single crystals has precluded the evaluation and testing of this material in the desired prototype devices. This situation has motivated development of a novel synthesis technique for attaining such crystals. This paper describes a unique modification (patent pending) of the conventional hydrothermal growth method which yields large (= 3 cm), high-optical-quality single crystals. The method permits continuous visual observation of the pressurized crystal growth process thus permitting close control of real-time nucleation and growth kinetics. The optimum conditions for attaining high quality crystals such as temperature-ramp rates, reagent concentration and purity, system design, and ampoule configuration are presented. GRA

N81-12906# Army Electronics Research and Development Command, Fort Monmouth, N. J.

SECOND HARMONIC GENERATION OF NEAR MILLIMETER WAVE RADIATION BY NONLINEAR BULK MATERIAL

Byong H. Ahn Jun. 1980 15 p refs

(AD-A090351) Avail: NTIS HC A02/MF A01 CSCL 09/1

Bulk crystals have been used frequently to obtain second harmonic generation (SHG) and third harmonic generation (THG) of radiation from the fundamental input frequency, particularly in the optical region. For example ammonium dihydrogen phosphate, potassium dihydrogen phosphate, semiconductor

materials, and ferroelectric materials were used for the SHG of input laser beams. SHG and THG have also been realized in the microwave region. Boyd, et. al., reported on the nonlinear coefficients and other important parameters at 55 GHz. Later, Boyd and Pollack published a comprehensive paper on the nonlinear coefficients of LiTaO3 and LiNbO3 in the microwave region. DiDomenico, Jrl, et. al., obtained a 9 GHz TH output with an efficiency of 8.5% from a 2200 watt 3 GHz source by use of a 73% BaTiO3 - 27% SrTiO3 ceramic in a coaxial cavity configuration. Impetus for bulk harmonic generation in the microwave region was given by the discovery that some ferroelectric crystals have very large nonlinear coefficients, large enough to compensate for the lower frequencies of the microwave region in comparison to those of the optical region. GRA

N81-12907# Maryland Univ., College Park. Dept. of Physics and Astronomy.

INVESTIGATION OF NOISE IN SOLIDS AT LOW TEMPERATURES Annual Report, 1 Mar. 1979 - 28 Feb. 1980

William S. Davis, K. Krack, J. P. Richard, and J. Weber Aug. 1980 120 p refs

(Contract F49620-77-C-0065; AF Proj. 2309)

(AD-A090805; AFOSR-80-1008TR) Avail: NTIS HC A06/MF A01 CSCL 20/1

This research is concerned with the theory and observations of fluctuation phenomena. Observations have been made of the thermal fluctuations associated with the normal modes of oscillation of an aluminum cylinder at 4 Kelvin. A summary has been accepted by the Physical Review, and a preprint is included here. Progress has been made in solving the difficult problems associated with noise measurements in high quality factor (Q approx. 10 to the 8th power to 10 to the 9th power) silicon and sapphire crystals. The present status is summarized, together with a description of a new large Dewar capable of cooling a large volume (35 liters to 20 millikelvin). A new approach has been discovered for increasing the interaction of weak forces with a detection system. This makes use of correlated quantum states. In certain cases transition probabilities are proportional to the first power instead of the usual square of the interaction. This offers possibilities for enormous increases in transition rates. Preprints of two papers submitted for publication are included. GRA

N81-12908# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.

RESEARCH IN MULTI-COLOR THIN FILM EMITTERS Progress Report, 15 Mar. 1979 - 31 Mar. 1980

L. G. Hale Jul. 1980 25 p refs

(Contract N00014-79-C-0341)

(AD-A090472; ERC41026/1PR) Avail: NTIS HC A02/MF A01 CSCL 20/3

A green thin film electroluminescent emitter has been developed capable of greater than 700 fL brightness. This is the brightest green EL device reported to date. The device is a multi-layer structure consisting of ZnS:TbF3 layer sandwiched between two dielectric layers of Y2O3. GRA

N81-12909# RCA Labs., Princeton, N. J.

PASSIVATION OF GaAs SURFACES Final Report, 1 Jan. - 30 Jun. 1980

J. I. Pankove 15 Aug. 1980 22 p refs

(Contract F49620-80-C-0039; AF Proj. 2305)

(AD-A090512; PRRL-80-CR-28; AFOSR-80-1029TR) Avail: NTIS HC A02/MF A01 CSCL 20/12

Various approaches to passivating the surface of GaAs have been explored. All of these were aimed at tying dangling bonds with atoms bonding more tightly than either Ga or As. Atomic species of hydrogen and nitrogen were generated by a glow discharge in H2, NH3, or N2. Nitridization with ammonia appears most promising. The degree of passivation was monitored by photoluminescence. A fourfold improvement in luminescence efficiency was obtained with nitridization while a factor of ten improvement can be obtained with the less practical technique of generating an (AlGa)As skin. GRA

N81-12910# Xerox Palo Alto Research Center, Calif.

DYNAMIC PROPERTIES OF ELECTRONIC TRAPPING CENTERS AT THE SiSiO2 INTERFACE Final Report, 29 Jun. 1979 - 30 Jun. 1980

N. M. Johnson Sep. 1980 25 p refs

(Contract DAAG29-79-C-0116)

(AD-A090584; ARO-16863.1-A-EL) Avail: NTIS HC A02/MF A01 CSCL 20/12

The Si-SiO2 interface possesses defects which may be considered characteristic of the thermal oxidation process. Electronic defects introduce a broad peak in the interface-state distribution which is centered approximately 0.3 eV above the silicon valence-band maximum. Furnace anneals remove these levels yielding the generally observed U-shaped distribution. The ESR interface defect was evaluated over a range of annealing temperatures (less than or equal to 600 C). The spin signal rapidly decays in MOS structures annealed above 250 C. An anneal in atomic deuterium at 230 C completely annihilated the spin center, which could not be recovered with vacuum anneals up to 600 C. The surface-potential dependence of the interface spin center was investigated in order to further establish the correlation between the paramagnetic defect and interface states. It was found that the ESR amplitude changes reversibly by approximately 25% as the surface potential is adjusted between inversion and accumulation conditions. GRA

N81-12911# Vermont Univ., Burlington. Dept. of Chemistry.

MAGNETIC PROPERTIES AND MOESSBAUER SPECTRA OF SEVERAL IRON (3) DICARBOXYLIC ACID COMPLEXES

Chester T. Dziobkowski, James T. Wrobleski, and David B. Brown 1 Oct. 1980 37 p refs Submitted for publication

(Contract N00014-75-C-0756)

(AD-A090705; TR-21) Avail: NTIS HC A03/MF A01 CSCL 07/3

Polymeric iron (3) complexes of malonic, succinic, furmaric, and phthalic acids have been prepared and studied by variable-temperature (15-300 K) magnetic susceptibility, 57Fe Mossbauer spectroscopy, and infrared spectroscopy. In addition, properties of iron(3) acetate have been reinvestigated using these same techniques. The magnetic susceptibilities of these complexes have been described by a theoretical model which includes, in addition to intramodular exchange terms, a parameter describing intermolecular spin-exchange effects. As a consequence of this model it was not necessary to assume an isosceles triangular arrangement of the iron(3) ions in these materials in order to explain the magnetic data. Thus, the inclusion of an intertrimer exchange parameter, which varies from 1/2.1 cm for the acetate complex to 1/11.7 cm for the o-phthalate complex allowed for a complete description of the temperature-dependence of the magnetic susceptibilty of these compounds. Mossbauer and infrared spectroscopic studies were utilized to ascertain the correctness of oxidation state and structural assignments. GRA

N81-12912# Vermont Univ., Burlington. Dept. of Chemistry.

A STUDY OF MAGNETIC AND SPECTROSCOPIC PROPERTIES OF Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O OR C5H5N. DIRECT OBSERVATION OF THE THERMAL BARRIER TO ELECTRON TRANSFER IN A MIXED VALENCE COMPLEX

Chester T. Dziobkowski, James T. Wrobleski, and David B. Brown 1 Oct. 1980 32 p refs Submitted for publication

(Contract N00014-75-C-0756; NR Proj. 356-593)

(AD-A090706; TR-22) Avail: NTIS HC A03/MF A01 CSCL 07/3

The mixed-valence iron (2, 3, 3) acetates, (Fe3O(CH3CO2)6L3), where L = water or pyridine, have been prepared and studied by Mossbauer, infrared, and optical spectroscopy and magnetic susceptibility methods. Variable-temperature magnetic susceptibility data for the aquo complex are interpreted on the basis of HDVV S2 = 2, S1 = S3 = 5/2 spin exchange model with J12 = j23 = 1/-50 cm and J13 = 1/14.5 cm. An intervalence transfer band is observed at 1/138000 cm in the room temperature electronic spectrum of the aquo complex. Mossbauer spectra of these compounds are markedly temperature dependent. At 17K absorptions due to distinct Fe(2) and Fe(3) sites are observed while at 300 K a single absorption is observed. Spectra at intermediate temperatures are modeled by assuming intratrimer electronic relaxation between pairs of iron ions. The activation energy for relaxation derived from this model is 1/470 cm for the aquo complex. This energy is equal to the

barrier to intramolecular, intervalence thermal electron transfer. GRA

N81-12913# Washington Univ., St. Louis, Mo. Semiconductor Research Lab.

EPITAXIAL GROWTH OF CdSnP2 ON InP FOR MICROWAVE FETs Final Technical Report, 1 Aug. 1977 - 31 Jul. 1980

C. M. Wolfe, G. A. Davis, and S. J. Hsieh 6 Oct. 1980 41 p refs

(Contract N00014-77-C-0664; RR0210203; NR Proj. 243-021)

(AD-A090285; Rept-64329-4) Avail: NTIS HC A03/MF A01 CSCL 20/12

CdSnP2 platelets were grown from Sn solutions to provide samples for characterizing ohmic and Schottky barrier contacts. High temperature Hall and resistivity measurements indicate that the observed n-type conductivity is due to a deficiency of the volatile constituents; probably phosphorus. Both liquid phase and molecular beam epitaxy were examined for the epitaxial growth of CdSnP2 on InP substrates. Best results were obtained with an open tube liquid phase system using a step-cooling technique. X-ray diffraction measurements indicate a lattice mismatch of about - 0.5% for these layers. GRA

N81-12914# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

***CATHODOLUMINESCENCE CHARACTERIZATION OF ION IMPLANTED GaAs* Ph.D. Thesis**

Milton L. Cone Mar. 1980 134 p refs

(AD-A090302; AFIT/DS/PH/80-1) Avail: NTIS HC A07/MF A01 CSCL 07/4

The unique properties of GaAs make it possible to construct integrated circuit devices that are impossible in Si. The Air Force Avionics Laboratory/AADR has been developing this technology for a number of years. The difficulty of introducing dopants by diffusion has lead ion implantation to play an increasing role in the fabrication process. The present production technique for high performance devices is to fabricate large quantities and select those few that meet the desired specifications. Having a nondestructive technique that can be used to characterize the implantation process during fabrication of the device so as to reject faulty device structures can save valuable time as well as money. Depth-resolved cathodoluminescence is a process that can be used for this purpose. This research develops and verifies a model of cathodoluminescence in ion implanted GaAs. This model can now be used as a tool for further study of ion implanted GaAs. This is the first step in developing cathodoluminescence as a tool for deducing the shape of the ion implanted depth profile in semiconductor materials. GRA

N81-12915# *Chicago Univ., Ill.*

ADSORPTION OF OXYGEN ON THE (110) PLANE OF TUNGSTEN AT LOW TEMPERATURES

H. Michel, R. Opila, and R. Gomer 6 Oct. 1980 25 p refs Sponsored in part by NSF

(Contract N00014-77-C-0018)

(AD-A090604; TR-5) Avail: NTIS HC A02/MF A01 CSCL 07/4

Isotope labelling experiments have established that the adsorption of O2 on the W(110) plane at 20 K leads first to the formation of a dissociated atomic layer. A weakly bound molecular species, alpha-O2, forms only when the atomic layer is essentially complete (O/W = 0.6). The desorption of alpha-O2 was found to be first order with an activation energy of E = 1.9 Kcal/mole and a frequency factor gamma = 3 x 10 to the 9th power. The activation energy is shown to be less than the enthalpy of desorption and the meaning of this result is discussed. GRA

N81-12916# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Ceramic Engineering.

CHARACTERIZATION OF INTERNAL BOUNDARY LAYER CAPACITORS

H. D. Park and D. A. Payne May 1980 24 p refs Presented at Intern. Symp. on Grain Boundary Phenomena in Electron. Ceram., Chicago, 29 Apr. 1980 Submitted for publication Sponsored in part by Ferro Corp.

(Contract DE-AC02-76ER-01198)

(DOE/ER-01198/1311; CONF-8004105-1) Avail: NTIS HC A02/MF A01

Internal boundary layer capacitors are characterized by scanning transmission electron microscopy and by microscale electrical measurements. Data are given for the chemical and physical characteristics of the individual grains and boundaries, and their associated electric and dielectric properties. Segregated internal boundary layers are identified with resistivities of 10 to the 12th power to 10 to the 13th power omega-cm. Bulk apparent dielectric constants were 10,000-60,000. A model is proposed to explain the dielectric behavior in terms of an equivalent n-c-i-c-n representation of ceramic microstructure, which is substantiated by capacitance-voltage analysis. DOE

N81-12917# California Univ., Berkeley. Lawrence Berkeley Lab. *Materials and Molecular Research Div.*

MICROSTRUCTURE AND DOMAIN STRUCTURE OF PZT M.S. Thesis

Edward K. W. Goo Mar. 1980 51 p refs

(Contract W-7405-eng-48)

(LBL-10651) Avail: NTIS HC A04/MF A01

The microstructure and domain structure of polycrystalline lead-zirconate titanate was studied by transmission electron microscopy. An amorphous phase of approximately 100 A thickness is found at the grain boundaries. The domain structure observed is similar to single crystal BaTiO3. The thickness of the 90 C domain walls is determined to be less than 100 A. ZrO2 particles are present in the material. DOE

N81-12918# *Ames Lab., Iowa. Physics Dept.*

ELECTRONIC BAND STRUCTURE AND OPTICAL PROPERTIES OF THE CUBIC, Sc, Y AND La HYDRIDE SYSTEMS Ph.D. Thesis

Douglas Jay Peterman 1980 122 p refs

(Contract W-7405-eng-82)

(IS-T-899) Avail: NTIS HC A06/MF A01

Electronic band structure calculations are used to interpret the optical spectra of the cubic Sc, Y and La hydride systems. Self consistent band calculations of ScH2 and YH2 were carried out. The respective joint densities of states are computed and compared to the dielectric functions determined from the optical measurements. Additional calculations were performed in which the Fermi level or band gap energies are rigidly shifted by a small energy increment. These calculations are then used to simulate the derivative structure in thermomodulation spectra and relate the origin of experimental interband features to the calculated energy bands. While good systematic agreement is obtained for several spectral features, the origin of low energy interband transitions in YH2 cannot be explained by these calculated bands. DOE

N81-12919# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.

SIMULATION OF THE STRUCTURE OF VACANCIES IN HIGH ANGLE GRAIN BOUNDARIES

P. D. Bristowe Jun. 1980 9 p refs

(Contract DE-AS02-78ER-05002)

(COO-5002-10) Avail: NTIS HC A02/MF A01

A hard sphere dynamic model and a bubble raft model provided insight into the structure of a variety of defects in two dimensional crystalline and amorphous systems. The computed results form part of a wider investigation of vacancies and interstitials in various grain boundaries in which the binding energies are analyzed and related to the defect structure and form of the interatomic potential. DOE

N81-12920# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

GRAIN BOUNDARY SEGREGATION AND INTERGRANULAR FAILURE

C. L. White 1980 65 p refs Presented at Intern. Al-Li Conf., Stone Mountain, Ga., 19 May 1980

(Contracts W-7405-eng-26; DE-AC05-76OR-00033; EY-76-C-05-0033)

(CONF-8005109-1(Draft)) Avail: NTIS HC A04/MF A01

Trace elements and impurities often segregate strongly to grain boundaries in metals and alloys. Concentrations of these elements at grain boundaries are often 1,000 to 100,000 times

as great as their overall concentration in the alloy. Because of such segregation, certain trace elements can exert a disproportionate influence on material properties. One frequently observed consequence of trace element segregation to grain boundaries is the occurrence of grain boundary failure and low ductility. Less well known are incidences of improved ductility and inhibition of grain boundary fracture resulting from trace element segregation to grain boundaries in certain systems. An overview of trace element segregation and intergranular failure in a variety of alloy systems as well as results from studies on aluminum 3 percent lithium is presented. DOE

N81-12921# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.

CZOCHRALSKI GROWTH OF SINGLE-CRYSTAL GEHLENITE Ca2Al2SiO7

C. R. Finch, F. L. Ball, and J. B. Bates 1980 8 p refs Presented at 6th Intern. Conf. on Crystal Growth, Moscow, Sep. 1980

(Contract W-7405-eng-26)

(CONF-800908-2) Avail: NTIS HC A02/MF A01

Single crystal boules of gehlenite (Ca2Al2SiO7) were grown from even and off stoichiometry melts under differing conditions of oxygen fugacity. Growth was accomplished by the Czochralski method at 1600 C and 100,000 Pa (1 atm) total pressure, using inductively heated Ir or Pt-20% Rh crucibles. Colorless, transparent material up to 8 mm diam. by 15 mm long was obtained from the evenly stoichiometric melt composition under Ar at growth rates of 1.5 mm/h or less. Growth at rates exceeding 2 mm/h or growth at a high oxygen fugacity, led to the formation of bubbles and elongated voids or inclusions, predominantly in the core regions of boules. Optical, X-ray diffraction, and electron induced X-ray fluorescence data are included. DOE

N81-12922# Oak Ridge National Lab., Tenn.

COHERENT ABSORPTION AND EMISSION PROCESSES PENETRATING CRYSTALS

S. Datz 1980 10 p refs Presented at Intern. Conf. on X-ray Processes and Innershell Ionization, Stirling, England, 25 Aug. 1980

(Contract W-7405-eng-26)

(CONF-800859-3) Avail: NTIS HC A02/MF A01

Swift charged particles moving through an ordered array of atoms in a crystal experience periodic perturbations which can give rise to coherent absorption or emission of photons. Indeed the phenomenon of coherent bremsstrahlung arising from ultrarelativistic electron penetration of crystals were studied for many years. Studies of resonant coherent excitation of channeled ions constitute a form of absorption spectroscopy which yields information on the ionic states and the crystalline milieu. Experimental observation of both the absorption and emission phenomena in channeling has occurred only in the past two years. A brief review and collation of the various effects observed are presented. DOE

N81-12923# Ames Lab., Iowa.

SUPERCONDUCTIVITY AND LONG RANGE MAGNETIC ORDER IN THE BODY-CENTERED TETRAGONAL SYSTEM Er(Rh/SUB 1-x/Ru/SUB x)4B4

H. E. Horng and R. N. Shelton 1980 10 p refs Presented at the Ternary Superconductors Conf., Lake Geneva, Wis., 24-26 Sep. 1980 Prepared in cooperation with Iowa State Univ. of Science and Technology, Ames

(Contract W-7405-eng-82)

(IS-M-295; CONF-800954-3) Avail: NTIS HC A02/MF A01

In the system Er(Rh/sub 1-x/Ru/sub x/)4B4, the compound ErRu4B4 orders magnetically at T/sub m/ = 2.1 K; whereas, compounds for 0.05 = or < x = or < 0.40 become superconducting at T/sub c/ approximately greater than 7.5 K. The details of these low temperature states are investigated via a series of measurements on 19 samples with 0.05 = or < x = or < 1.00. T/sub c/ is relatively composition independent up to x approximately equals 0.40, followed by a sharp drop for x values between 0.40 and 0.50. This critical composition for the destruction of superconductivity, x/sub cr/ approximately equals 0.50, is not influenced by the magnetic properties of the rare earth. T/sub m/ is depressed when Rh is substituted for Ru and for this system superconductivity and long range magnetic order are mutually exclusive. DOE

N81-12924# Ames Lab., Iowa.

***EFFECT OF PRESSURE ON THE SUPERCONDUCTING AND* MAGNETIC CRITICAL TEMPERATURES OF bct TERNARY RUTHENIUM BORIDES**

R. N. Shelton, C. U. Segre, and D. C. Johnston 1980 10 p refs Presented at Ternary Superconductors Conf., Lake Geneva, Wis., 24 Sep. 1980

(Contract W-7405-eng-82)

(IS-M-293; CONF-800954-2) Avail: NTIS HC A02/MF A01

The effects of hydrostatic pressure to 21 kbar on the superconducting (T sub c) and magnetic (T sub m) critical temperatures are reported for thirteen body centered tetragonal isomorphous compounds in the systems RERu4B4 and RE(Rh0.85Ru0.15)4B4 (RE = Pr,Nd,Gd,Tb,Dy,Ho,Er,Tm,Lu). Comparison of the two superconducting Lu compounds reveals a marked distinction between the volume dependence of T sub c due to external pressure and the effect caused by alloying on the transition metal site which also affects unit cell volume. A contrasting behavior under pressure is observed for the magnetic and superconducting states for the three pairs of compounds comprised of RE = Dy,Ho,Er. DOE

N81-12925# Siemens A.G., Munich (West Germany). Unternehmensbereich Bauelemente.

HOMOGENEOUS PHOSPHORUS DOPING OF SILICON BY NEUTRON TRANSMUTATION Final Report, Jun. 1978

Heinz Mitlehner, Manfred Schnoeller, and Peter Voss Bonn Bundesministerium fuer Forschung und Technologie Nov. 1979 73 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-79-52; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 14,90

The manufacture of high voltage power semiconductors requires homogeneous phosphorus doping of silicon within extremely narrow limits. Neutron irradiation as a means to homogeneously dope silicon with phosphorus on an industrial scale was investigated. Special attention was given to the selection of suitable reactor positions, to the annealing of irradiation damage, and to the electrical properties of the devices. Experience gained in the application of neutron irradiated silicon for a wide spectrum of devices shows that expected homogeneity and aiming accuracy with respect to the doping can be reached with high reliability. Author (ESA)

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-12926# Deputy Chief of Staff for Research Development and Acquisition (Army), Washington, D.C.

REDEFINITION OF THE FOUR FUNDAMENTAL FORCES

Robert J. Heaston Jun. 1980 15 p refs

(AD-A090401) Avail: NTIS HC A02/MF A01 CSCL 20/10

Unification of the fundamental forces has been one of the great theoretical problems in physics in the twentieth century. Beginning in 1918 with Weyl and continuing through the last thirty five years of Einstein's life, many different attempts were made to unify the electromagnetic and the gravitational forces. Moreover, since the four fundamental forces were first defined in the early forties, extensive efforts by numerous investigators have gone into measuring and attempting to unify two or more of these forces. This paper defines the four forces and discusses some of the difficulties in unifying the forces. A new approach to unification will be presented with a discussion of the consequences and predictions of this approach. The four fundamental forces are defined. These four forces are all that

are necessary to characterize all phenomena. From an Army perspective, the strong force is only of interest in the basic structure of matter and in nuclear weapons effects. The electromagnetic force is involved in the structure of matter, all electronic devices, all chemical reactions, explosives, and propellants. The weak force occurs in nuclear weapons effects. The gravitational force becomes involved in every load carrying device and in the motion of aircraft, projectiles and missiles. Frequently, such as in a fuze, more than one force is involved. GRA

N81-12927# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTATIONAL PHYSICS PROGRAM OF THE NATIONAL MFE COMPUTER CENTER
Arthur A. Mirin Aug. 1980 35 p refs Revised
(Contract W-7405-eng-48)
(UCID-175530-Rev-1) Avail: NTIS HC A03/MF A01

The computational physics group is involved in several areas of fusion research. One main area is the application of multidimensional Fokker-Planck, transport and combined Fokker-Planck/transport codes to both toroidal and mirror devices. Another major area is the investigation of linear and nonlinear resistive magnetohydrodynamics in two and three dimensions, with applications to all types of fusion studies, investigation of more efficient numerical algorithms are being carried out. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-12928# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.
ARE MANAGEMENT PROBLEMS IN THE ACQUISITION OF AIRCRAFT GAS TURBINE ENGINES BEING CORRECTED
30 Sep. 1980 75 p
(AD-A090520; GAO/PSAD-80-72) Avail: NTIS HC A04/MF A01 CSCL 05/1

Recent problems with fighter/attack aircraft engines have been primarily due to the development concepts, procedures, and practices that did not provide the time and money to (1) adequately develop the engines before production and use and (2) bring promising technology up to the point that it was ready for applications in new engines. Other major factors that adversely affected engine development were: inadequate definition of the engines' usage and, consequently, the inability to design engines to their expected usage and to verify the design by testing to that usage; emphasis on performance requirements with a resulting lack of standards, data base, and analytical procedures to achieve a balance among performance, operability, reliability, durability, and costs; and inadequate flight testing of engines. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N81-12929# Naval Underwater Systems Center, Newport, R. I.
CATALOGING PROCEDURES FOR THE LIBRARY MANAGEMENT AND RETRIEVAL SYSTEM (LMARS)
Elizabeth Redfield 17 Sep. 1980 35 p refs
(AD-A090712; NUSC-TD-5868) Avail: NTIS HC A03/MF A01 CSCL 05/2

The cataloging procedures for the Library Management and Retrieval System (LMARS) were developed to give Naval Underwater Systems Center (NUSC) Technical Library catalogers an efficient, coherent set of standards to use in entering records into the LMARS data base. The procedures were designed by modifying and adapting existing NUSC cataloging practices for consistent and practical application to the LMARS data base used by the NUSC Technical Libraries at the Newport and New London Laboratories. GRA

N81-12930# Naval Underwater Systems Center, Newport, R. I.
A CATALOGER'S GUIDE TO THE LMARS REPORT NUMBER. AUTHORITY FILE IN USE AT THE NAVAL UNDERWATER SYSTEMS CENTER
Tosca Nalli Carpenter 15 Sep. 1980 72 p refs
(AD-A090713; NUSC-TD-5906) Avail: NTIS HC A04/MF A01 CSCL 05/2

This document presents the report number authority file used by catalogers at the Naval Underwater Systems Center technical library. It provides a standardized and consistent format for the entering of technical report information (originator and number) into the resident Library Management and Retrieval System (LMARS). GRA

N81-12931# Institut fuer Informationsverarbeitung in Technik und Biologie, Karlsruhe (West Germany).
HOLOGRAPHIC ASSOCIATIVE MEMORIES IN DOCUMENT RETRIEVAL SYSTEMS Final Report
Peter-Joachim Becker, Hermann Bolle, Arno Keller, Werner Kistner, Wolf Dieter Riecke, and Ulrike Wagner Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1979 232 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-DV-79-05; ISSN-0170-9011) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 48,75

A holographic memory with associative readout for a document retrieval system was implemented. Test run results show that by taking advantage of the favorable properties of holography (i.e., associative readout of the memory; parallel processing in the response store) shorter response times than with sequentially organized data memories are obtained. Such a system can also operate in the interactive mode including chain associations. In order to avoid technological difficulties, the experimental setup made use of commercially available components only. An improved holographic sturcture is proposed which uses volume holograms in photorefractive crystals as storage devices. A review of the state-of-the-art of electro-optic devices for coherent optical data processing and of competing technologies (semiconductor associative memories and associative program systems) is also presented. Author (ESA)

N81-12932# Royal Aircraft Establishment, Farnborough (England).
A SCIENTIFIC DATA BASE FOR THE ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH, ENGLAND
T. R. H. Sizer, S. Woodward, C. Graff, I. M. Cummings, and H. E. Taylor (Triad Computing Systems, Ltd.) London HMSO Apr. 1980 27 p refs
(RAE-TR-80048; RAE-IT-167; BR74911) Avail: NTIS HC A03/MF A01

A systems analysis was performed to determine scientific and administrative data processing requirements of a large scientific research laboratory. Commercial data base management systems (DBMS) were found to be unsuitable. A DBMS was designed, following recommendations of the CODASYL data base task group. It was implemented on an ICL 1904A and an ICL 1906S computer, using the high level language BCPL. The user defines the data structure in terms of data description languages.

The system uses an inverted file structure. Data are held in host operating system files, accessed by user programs invoking a FORTRAN subroutine call to a set of procedures called a data manipulation language (DML). The DML routines provide for location, storage, retrieval, modification, and deletion of records. Results of performance tests and an example of a scientific data application are given. Author (ESA)

N81-12933# National Telecommunications and Information Administration, Washington, D.C.
THE FOUNDATIONS OF UNITED STATES INFORMATION POLICY
Arthur A. Bushkin and Jane H. Yurow Jun. 1980 20 p Presented at the Conf. on Inform., Computer, and Commun. Policy Organ. for Econ. Cooperation and Develop., Paris, 6-8 Oct. 1980
(PB80-204019; NTIA-SP-80-8) Avail: NTIS HC A02/MF A01 CSCL 05B

Certain fundamental policy assumptions emerge as the foundation of United States policies, although there is a need to strike balances in the significant tensions among these assumptions. These assumptions, as they manifest themselves in the information policies of the United States, and highlights of the tradeoffs which they imply are presented. The policies presented herein form the principles upon which the United States generally approaches international information policy issues.GRA

N81-12934# National Technical Information Service, Springfield, Va.
ON-LINE INFORMATION RETRIEVAL SYSTEMS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Sep. 1980
Mary E. Young Sep. 1980 198 p Supersedes NTIS/PS-79/0971; NTIS/PS-78/0979
(PB80-814841; NTIS/PS-79/0971; NTIS/PS-78/0979) Avail: NTIS HC $30.00/MF $30.00 CSCL 05B

On-line computer systems for retrieval of information are described in the reports cited. Systems development, formats of large and small systems, instructions for use and comparisons of operating networks are included. This updated bibliography contains 193 citations, 75 of which are new entries to the previous edition. GRA

N81-12935# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
AGARD INDEX OF PUBLICATIONS 1977-1979
Aug. 1980 428 p
(AGARD-Index-77-79; ISBN-92-835-1369-X) Avail: NTIS HC A19/MF A01

A bibliography containing approximately 4,300 entries addressing various topics in aerospace engineering and related areas is given. Subjects include aircraft design, instrumentation, and propulsion; aerodynamics; communications; missile control; aerospace medicine; and quality control. M.G.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-12936# Naval Data Automation Command, Washington, D.C.
ECONOMIC ANALYSIS PROCEDURES FOR ADP
Denise C. Zimmerman Mar. 1980 201 p refs
(AD-A089826; NAVDAC-PUB-15) Avail: NTIS HC A10/MF A01 CSCL 05/3

Every manager devotes considerable time and effort to planning for the future, and every plan is concerned primarily with allocating scarce resources. This book explains a process which will aid the manager in making resource allocation decisions. This method of approaching a complex problem of choice is called Economic Analysis. Economic Analysis concerns the basic problem of economic choice (value received for value sacrificed) and as such, is applied by each of us implicitly and informally whenever we make a decision in the marketplace. For example, when we buy a car we do not take the first one we see. We look around until we find a model that suits our needs and our pocketbooks. In effect, we make an economic analysis, even if we don't call it that. This book was written in order to establish a procedural routine for personnel who have little or no experience with economic analyses. It will also be of value to those supervisors and functional managers who must initiate or review economic analyses. While the technique described throughout the book can be easily applied to all types of investment problems, the scope of this book is limited to economic problems of choice within the ADP arena. GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-12937# Committee on Commerce, Science, and Transportation (U. S. Senate).
THE MOON TREATY
Washington GPO 1980 271 p refs Hearings before the Subcomm. on Sci., Technol., and Space of the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 29 and 31 Jul. 1980
(GPO-66-705) Avail: Subcommittee on Science, Technology, and Space

The advantages and disadvantages are discussed relative to U.S. adherence to a treaty which requires each member state, at some relatively distant point in the future, to negotiate in good faith toward the establishment of an international regime to govern the exploitation on natural resources of the Moon and/or other celestial bodies. The meaning of the phrase 'common heritage of all mankind' and the potential for international control over national activities in space are a considered as well as the technology, cost, scheduling, and celestial bodies which might be exploited. A.R.H.

N81-12938# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1982 (PROGRAM REVIEW), VOLUME 1
Washington GPO 1980 161 p Hearing before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci., and Technol., 96th Congr., 2nd Sess., no. 147, 9 Sep. 1980 (GPO-68-972) Avail: Subcommittee on Transportation, Aviation, and Communications

The progress and status of NASA's Aeronautics Research and Technology (R&T) programs in FY 1980 is reported. The character of the overall Aeronautics program is summarized and the accomplishments are reviewed. The Aeronautics R&T budget for FY 1980 is summarized in terms of the major budget categories and major program categories. The disciplines of aerodynamics, materials and structures, propulsion, guidance and control, human factors, and simulation technology are discussed. Vehicle classes discussed include transport aircraft, general aviation, low speed aircraft, and high speed aircraft. J.M.S.

N81-12939# Committee on Commerce, Science, and Transportation (U. S. Senate).
AGREEMENT GOVERNING THE ACTIVITIES OF STATES ON THE MOON AND OTHER CELESTIAL BODIES, PART 4
Washington GPO 1980 142 p refs Rept. presented to the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., Nov. 1980 Prepared by Congressional Research Service, Library of Congress
(GPO-68-636) Avail: SOD HC

The technical, foreign policy, and legal issues which may arise in connection with examination of the Moon Treaty are reviewed from an interdisciplinary viewpoint. The history and text of the treaty are documented and possible implications for commercial space industrialization are considered. Other aspects discussed include national defense, environment protection, present and future space technology, a mandatory international regime, and arguments in favor and in opposition to the treaty. The text of the 1967 Outer Space Treaty is included along with proposals submitted by Argentina, the U.S.S.R., and the United States. Working group revisions and the agreement as com-

mended by the U.N. General Assembly are also presented. Current signatories to the treaty are listed. A.R.H.

N81-12940# Committee on Appropriations (U. S. Senate).
SPACE SHUTTLE AND GALILEO MISSION
Washington GPO 1980 136 p Hearings before a Subcomm. of the Comm. on Appropriations, 96th Congr., 1st Sess., 1980 (GPO-53-938) Avail: SOD HC

Progress in the development of the space shuttle is discussed in terms of cost overruns and delays in the first manned orbital flight of the shuttle. Results of NASA's financial requirements review of the shuttle funding are presented and discussed with emphasis placed on NASA's management of the space shuttle program. The status of Spacelab activities, the status of the upper stages, thrust augmentation to enhance shuttle capability, preparations for integrated mature STS operations, and the transition from expendable launch vehicles to space shuttle are among the topics discussed. The program status and mission objectives of the Galileo program are also reviewed. Options studied when it became necessary to restructure the mission are discussed and program modifications necessary for a 1984 launch are outlined. Estimated program costs are included. J.M.S.

N81-12941# Committee on Science and Technology (U. S. House).
UNITED STATES CIVILIAN SPACE POLICY
Washington GPO 1980 249 p refs Hearings before the Comm. on Sci. and Technol., 96th Congr., 2d Session, no. 153, 23-24 Jul. 1980
(GPO-66-883) Avail: Subcommittee on Space Science and Applications

The wisdom of the administration's contention that there is no need to initiate new, high challenge, high visibility engineering missions in space is examined in testimony delivered and statements presented for the record. To energize the nation's space program, it is suggested that promising long range goals must be established in science, technology, and economic applications. Reliable low cost, shuttle-based transportation to orbit must be followed by a practical, reusable interorbit and lunar transportation system. Permanent research and operating bases must be built in low Earth orbit, in geosynchronous orbit, and later, on the Moon. Quantitative growth in communications and remote sensing services must be accompanied by an increased level of performance and flexibility. Continued exploration of our solar system using robot spacecraft, the exploitation of extraterrestrial resources, and the preservation of peace between the superpowers through international cooperation require further technology developments. A.R.H.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N81-12942*# Texas A&M Univ., College Station. Dept. of Electrical Engineering.
BENT CRYSTAL X-RAY TOPOGRAPHY Final Report
D. L. Parker Aug. 1978 30 p refs
(Contract NAS8-32527)
(NASA-CR-150884) Avail: NTIS HC A03/MF A01 CSCL 20F

A television X-ray topographic camera system was constructed. The system differs from the previous system in that it incorporates the X-ray TV imaging system and has a semi-automatic wafer loading system. Also the X-ray diffraction is in a vertical plane. This feature makes wafer loading easier and makes the system compatible with any commercial X-ray generating system. Topographs and results obtained from a study of the diffraction contrast variation with impurity concentration for both boron implanted and boron diffused silicon are included. S.F.

N81-12943*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AERODYNAMIC DESIGN OF ELECTRIC AND HYBRID VEHICLES: A GUIDEBOOK
D. W. Kurtz 30 Sep. 1980 92 p refs
(Contracts NAS7-100; DE-AI01-78CS-4209)
(NASA-CR-163744; JPL-PUB-80-69) Avail: NTIS HC A05/MF A01 CSCL 13F

A typical present-day subcompact electric hybrid vehicle (EHV), operating on an SAE J227a D driving cycle, consumes up to 35% of its road energy requirement overcoming aerodynamic resistance. The application of an integrated system design approach, where drag reduction is an important design parameter, can increase the cycle range by more than 15%. This guidebook highlights a logic strategy for including aerodynamic drag reduction in the design of electric and hybrid vehicles to the degree appropriate to the mission requirements. Backup information and procedures are included in order to implement the strategy. Elements of the procedure are based on extensive wind tunnel tests involving generic subscale models and full-scale prototype EHVs. The user need not have any previous aerodynamic background. By necessity, the procedure utilizes many generic approximations and assumptions resulting in various levels of uncertainty. Dealing with these uncertainties, however, is a key feature of the strategy. Author

N81-12944*# Pioneer Engineering and Mfg. Co., Inc., Warren, Mich.
VEHICLE SYSTEMS DESIGN OPTIMIZATION STUDY Final Report
J. L. Gilmour Apr. 1980 182 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955498)
(NASA-CR-163797; DOE/JPL-955498-1; JPL-9950-404) Avail: NTIS HC A09/MF A01 CSCL 13F

The optimum vehicle configuration and component locations are determined for an electric drive vehicle based on using the basic structure of a current production subcompact vehicle. The optimization of an electric vehicle layout requires a weight distribution in the range of 53/47 to 62/38 in order to assure dynamic handling characteristics comparable to current internal combustion engine vehicles. Necessary modification of the base vehicle can be accomplished without major modification of the structure or running gear. As long as batteries are as heavy and require as much space as they currently do, they must be divided into two packages, one at front under the hood and a second at the rear under the cargo area, in order to achieve the desired weight distribution. The weight distribution criteria requires the placement of batteries at the front of the vehicle even when the central tunnel is used for the location of some batteries. The optimum layout has a front motor and front wheel drive. This configuration provides the optimum vehicle dynamic handling characteristics and the maximum passenger and cargo space for a given size vehicle. M.G.

N81-12945# Committee on Science and Technology (U. S. House).
STORAGE BATTERIES FOR ELECTRIC VEHICLE APPLICATIONS
Washington GPO 1980 202 p Hearing before the Subcomm. on Energy Res. and Production of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 84, 26 Nov. 1979
(GPO-57-671) Avail: SOD HC

The hearings before the House Subcommittee on Energy Research and Production concerning the development of storage batteries for electric vehicles are presented. The performances of various battery concepts are compared to that of alternative energy storage systems. Hybrid propulsion designs are also examined. Vehicle development and operation costs are discussed. M.G.

N81-12946# Committee on Science and Technology (U. S. House).
KEY ISSUES IN US-USSR SCIENTIFIC EXCHANGES AND TECHNOLOGY TRANSFER

Washington 1979 48 p refs Presented to the Comm. on Sci. and Technol. by the Subcomm. on Sci., Res., and Technol., 96th Congr., 1st Sess., Nov. 1979
(GPO-50-111) Avail: SOD HC

A summary and analysis of the hearings of the House Subcommittee on Science, Research, and Technology concerning scientific exchanges and technology transfer with U.S.S.R. is given. Economic, human rights, and national security issues are addressed. M.G.

N81-12947# Committee on Science and Technology (U. S. House).
TECHNOLOGY TRANSFER TO CHINA
Washington GPO 1980 239 p refs Hearings before the Subcomm. on Sci., Res., and Technol. and the Subcomm. on Invest. and Oversight of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 88, 13 and 15 Nov. 1979
(GPO-58-034) Avail: Subcommittee on Science, Research and Technology and the Subcommittee on Investigations and Oversight

The hearings before the House Subcommittee on Science, Research, and Technology and the Subcommittee on Investigations and Oversights addressing technology transfer to China are presented. The short and long term effects of massive technology transfer, China's policies with respect to the protection of patent rights and proprietary information, and the future role of China in the world market are examined. M.G.

N81-12948# Committee on Science and Technology (U. S. House).
TECHNOLOGY TRANSFER TO CHINA
Washington GPO 1980 37 p refs Presented to the Comm. on Sci. and Technol. by the Subcomm. on Invest. and Oversight
(GPO-62-976) Avail: SOD HC

A summary and analysis of the hearings of the House Subcommittee on Science, Research, and Technology and the Subcommittee on Investigations and Oversight concerning technology transfer to China is given. Recommendations concerning current U.S. policies in this area are also presented. U.S. export promotional activities and patent protection issues are discussed in addition to internal Chinese issues including financial constraints, sources of export, and ability to absorb technology. M.G.

N81-12949# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYBRID VEHICLE POTENTIAL ASSESSMENT. VOLUME 9: POWER TRAIN SUMMARY, COMPONENT DESCRIPTIONS, AND HYVEC VEHICLE SIMULATOR
S. G. Liddle and S. P. DeGrey DOE 30 Sep. 1979 34 p
(Contract EM-78-I-01-4209)
(CONS-4209-T1-Vol-9) Avail: NTIS HC A03/MF A01

A characterization of powertrain components for electric hybrid vehicles including heat engines; electric motor, generator, and controller; batteries; transmission; and chassis is given. In addition, the hybrid vehicle simulation program, HYVEC, is described. The general structure of the program is based on individual modeling of component performance and efficiencies, and power/speed paths from the wheels through the entire drive train. The basic design of the program allows maximum flexibility in sizing of vehicle components, i.e., engine and motor power, flywheel energy, and battery mass. M.G.

N81-12950# Ford Motor Co., Dearborn, Mich.
FORD/DOE SODIUM-SULFUR BATTERY ELECTRIC VEHICLE DEVELOPMENT AND DEMONSTRATION, PHASE 1-A Final Report
1979 184 p refs
(Contract EY-76-C-02-2566)
(COO-2566-53-T1; Rept-53) Avail: NTIS HC A09/MF A01

The results of Phase 1-A analyses and design studies conducted by Ford Motor Company for the U.S. Department of Energy are presented. The sodium-sulfur battery was evaluated, in an existing conventional production automobile, as a potential power source for an electric vehicle. T.M.

N81-12951# Department of Energy, Washington, D. C.
ENERGY ASPECTS OF DESIGNING ELECTRIC AUTOMOBILES AND ELECTRICAL TRANSMISSIONS FOR THEM
V. M. Kaveshnikov and Yu. I. Semikov 1979 10 p Transl. into ENGLISH from the 2d Soviet-Am. Symp. on Elec. Automobiles (USSR), 1979 Conf. held at Yerevan, USSR, 1979
(DOE-TR-229) Avail: NTIS HC A02/MF A01

At present, there is a great number of various designs in the world of electric automobiles in both passenger (light) models and in low capacity van models. A number of these designs were placed in production and some electric automobiles were and are being produced in small series and lots, but they are all designed chiefly for operation under urban conditions. It is obvious that this situation will continue in the near future. This report examines only passenger automobiles. The purpose of the report is to describe models for which research, development and production would be advisable at present and in the near future with respect to technical, economic, and social qualities. DOE

N81-12952# City of Los Angeles, Calif.
SOLAR ENVELOPE ZONING: APPLICATION TO THE CITY PLANNING PROCESS. LOS ANGELES CASE STUDY
Jun. 1980 192 p refs
(Contract DE-AC02-77CH-00178)
(SERI/SP-98156-1) Avail: NTIS HC A09/MF A01

Solar envelope zoning represents a promising approach to solar access protection. A solar envelope defines the volume within which a building will not shade adjacent lots or buildings. The feasibility of translating the concept of solar envelopes into zoning techniques was examined. Envelope zoning is a fair and consistent method of guaranteeing solar access, but problems of complexity and uncertainty may limit its usefulness. Envelope zoning may be inappropriate for the development of high density centers and for more restrictive community plans. Some combination of approaches, including publicly recorded easements, subdivision approval and envelope zoning, need to be adopted to encourage solar use in cities. DOE

N81-12953# Energy Research Corp., Danbury, Conn.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Jun. 1980 179 p
(Contracts W-31-109-38-4248; W-31-109-eng-38)
(ANL/OEPM-79-10; AR-1979-2) Avail: NTIS HC A09/MF A01

Nickel and zinc electrode development is discussed. Separator and sealed cell development is also discussed. The optimization of electrical performance, specifically, in terms of increased cycle life is described. T.M.

N81-12954# Eltra Corp., Plymouth Meeting, Pa. C and D Batteries Div.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF LEAD-ACID BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
G. W. Bodamer, G. C. Branca, H. R. Cash, J. R. Chrastina, and E. M. Yurick 11 Apr. 1980 83 p refs
(Contracts W-31-109-38-4206; W-31-109-eng-38)
(ANL/OEPM-79-7; FY-1979) Avail: NTIS HC A05/MF A01

The pilot line production of electric vehicle batteries by the expanded metal grid process is reported. A detailed summary of the manufacturing process is presented. The fabrication and testing of the initial batteries is discussed. Experimental results obtained under the advanced battery development program to enhance energy density and cycle life are presented. T.M.

N81-12985*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION SYSTEM RESEARCH AND DEVELOPMENT FOR ELECTRIC AND HYBRID VEHICLES
Harvey J. Schwartz *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 97-103 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 13F

N81-12986*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE FEDERAL ELECTRIC AND HYBRID VEHICLE PRO-

GRAM
Harvey J. Schwartz *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 105-109 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 13F

N81-12987*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JPL'S ELECTRIC AND HYBRID VEHICLES PROJECT: PROJECT ACTIVITIES AND PRELIMINARY TEST RESULTS
Thomas A. Barber *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 111-122 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 13F

88 SPACE SCIENCES (GENERAL)

N81-12955*# National Aeronautics and Space Administration, Washington, D. C.
SIGNIFICANT ACHIEVEMENTS IN THE PLANETARY GEOLOGY PROGRAM, 1980
Harry E. Holt, ed. Nov. 1980 38 p
(NASA-TM-82384) Avail: NTIS HC A03/MF A01 CSCL 03B

Recent developments in planetology research as reported at the 1980 NASA Planetology Program Principal Investigators meeting are summarized. Important developments are summarized in topics ranging from solar system evolution and comparative planetology to geologic processes active on other planetary bodies. Author

N81-12956# Office of Management and Budget, Washington, D. C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1979 ACTIVITIES
1979 119 p
Avail: NTIS HC A06/MF A01

Developments in communications, Earth resources sensing, space transportation, and space energy are summarized and the activities of NASA and the Departments of Commerce, Interior, Defense, Transportation, and Energy are delineated. Budgets for space ventures and aeronautics are tabulated. The White House fact sheet on the management of the U.S. civilian remote sensing is included along with the text of the United Nations Moon Treaty and an analysis and commentary by the Department of State. A.R.H.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-12957*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WHITE DWARF MODELS FOR TYPE 1 SUPERNOVAE AND QUIET SUPERNOVAE, AND PRESUPERNOVA EVOLUTION
Kenichi Nomoto Aug. 1980 10 p refs Presented at the IAU Colloq. No. 58, Los Alamos, N. Mex., 12-15 Aug. 1980 Submitted for publication
(NASA-TM-82030) Avail: NTIS HC A02/MF A01 CSCL 03A

Supernova mechanisms in accreting white dwarfs are considered with emphasis on deflagration as a plausible mechanism for producing Type I supernovae and electron captures to form quiet supernovae leaving neutron stars. These outcomes depend on accretion rate of helium, initial mass and composition of the white dwarf. The various types of hydrogen shell burning in the presupernova stage are also discussed. A.R.H.

N81-12958*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION OF THE CORE OF THE PERSEUS CLUSTER WITH THE EINSTEIN SOLID STATE SPECTROMETER: COOLING GAS AND ELEMENTAL ABUNDANCES
R. F. Mushotzky, S. S. Holt, B. W. Smith, E. A. Boldt, and P. J. Serlemitsos Nov. 1980 18 p refs Submitted for publication
(NASA-TM-82038) Avail: NTIS HC A02/MF A01 CSCL 03A

Solid State Spectrometer observations of the core of the Perseus cluster have resulted in the detection of X-ray emission lines due to Si, S, and Fe. Analysis of the spectrum indicates that the X-ray emission has at least two characteristic temperatures. This is interpreted in the framework of radiative accretion in the core of the cluster. The derived parameters are a cooling time tc less than 2 x 109 yrs for the low temperature gas, a mass accretion rate of approximately 300 Mo/yr and a characteristic size of 10 to 20 Kpc for the cool gas. The Fe abundance in the core, approximately 0.4, is similar to the Fe abundance averaged over the whole cluster indicating that Fe emission is not strongly concentrated about NGC 1275. The Si and S abundances are consistent with solar values. Author

N81-12959*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FUTURE PROSPECTS FOR GAMMA-RAY
Carl Fichtel Nov. 1980 20 p refs Presented at the Royal Soc. Discussion Meeting on Gamma-Ray Astronomy, 27-28 Nov. 1980
(NASA-TM-82041) Avail: NTIS HC A02/MF A01 CSCL 03A

Astrophysical phenomena discussed are: the very energetic and nuclear processes associated with compact objects; astrophysical nucleo-synthesis; solar particle acceleration; the chemical composition of the planets and other bodies of the solar system; the structure of our galaxy; the origin and dynamic pressure effects of the cosmic rays; the high energy particles and energetic processes in other galaxies, especially active ones; and the degree of matter antimatter symmetry of the universe. The gamma ray results of GAMMA-I, the gamma ray observatory, the gamma ray burst network, solar polar, and very high energy gamma ray telescopes on the ground provide justification for more sophisticated telescopes. S.F.

N81-12960# Los Alamos Scientific Lab., N. Mex.
SEARCH FOR FAINT GALACTIC FEATURES
W. Matuska and M. S. Burkhead 1980 16 p refs Presented at Conf. on Appl. of Digital Image Process. to Astronomy, Pasadena, Calif., 20 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2357; CONF-800853-1) Avail: NTIS HC A02/MF A01

Trying to determine the size of galaxies and looking for tails and connections between galaxies can be intriguing. These very faint features are often buried in the film grain noise. The search for these faint features is complicated by film variation, sky background, microdensitometer drift and stars in the neighborhood of the galaxies. These questions are addressed and faint features are found with the use of judicious data stretching and averaging along suspected features of the NGC 3623, NGC 3627, and NGC 3628 region. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-12961*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for High Energy Astrophysics.
AN X-RAY SURVEY OF NINE HISTORICAL NOVAE
R. H. Becker and F. E. Marshall Sep. 1980 13 p refs Submitted for publication
(NASA-TM-82014) Avail: NTIS HC A02/MF A01 CSCL 03B

The Einstein Observatory imaging proportional counter was

used to search for X-ray emission from nine nearby historical novae. Six of the novae were detected with estimated X-ray intensities between .1 to 4 keV of 10 to the -13th power to 10 to the -11th power ergs/sq cm-s, comparable to the intensities of previously detected cataclysmic variables. The X-ray intensity of one of the novae, V603 Aql, varies over times of several hundred seconds. The data suggest a correlation between the decay rate of the historical outburst and the current X-ray luminosity. Alternatively, the X-ray luminosity may be related to the inclination of the binary system. Author

N81-12962*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
PULSAR GAMMA-RAYS: SPECTRA LUMINOSITIES AND EFFICIENCIES
Alice K. Harding Sep. 1980 26 p refs Submitted for publication
(NASA-TM-82026) Avail: NTIS HC A03/MF A01 CSCL 03B

The general characteristics of pulsar gamma ray spectra are presented for a model where the gamma rays are produced by curvature radiation from energetic particles above the polar cap and attenuated by pair production. The shape of the spectrum is found to depend on pulsar period, magnetic field strength, and primary particle energy. By a comparison of numerically calculated spectra with the observed spectra of the Crab and Vela pulsars, it is determined that primary particles must be accelerated to energies of about 3 x 10 to the 7th power mc sq. A genaral formula for pulsar gamma ray luminosity is determined and is found to depend on period and field strength. E.D.K.

N81-12963*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD DIRECTIONAL DISCONTINUITIES. 2: CHARACTERISTICS BETWEEN 0.46 AND 1.0 AU
R. P. Lepping and K. W. Benhannon Nov. 1980 51 p refs (NASA-TM-82036; Rept-695) Avail: NTIS HC A04/MF A01 CSCL 03B

The characteristics of directional discontinuities (DD's) in the interplanetary magnetic field are studied using data from the Mariner 10 primary mission between 1.0 and 0.46 AU. Statistical and visual survey methods for DD identification resulted in a total of 644 events. Two methods were used to estimate the ratio of the number of tangential discontinuities (TD's) to the number of rotational discontinuities (RD's). Both methods show that the ratio of TD's to RD's varied with time and decreased with decreasing radial distance. A decrease in average discontinuity thickness of approx. 40 percent was found between 1.0 and 0.72 AU and approx. 54 percent between 1.0 and 0.46 AU, independent of type (TD or RD). This decrease in thickness for decreasing r is in qualitative agreement with Pioneer 10 observations between 1 and 5 AU. When the individual DD thickness are normalized with respect to the estimated local proton gyroradius (RA sub L), the average thickness at the three locations is nearly constant, 43 + or - 6 R sub L. This also holds true for both RD's and TD's separately. Statistical distributions of other properties, such as normal components and discontinuity plane angles, are presented. M.G.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-12964* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VOYAGER ENCOUNTERS SATURN: SCIENTIFIC HIGHLIGHTS
19 Dec. 1980 9 p
(NASA-News-Release-80-192; P80-10202) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

Observations generated by Voyager 1's encounter with Saturn are disclosed. Atmospheric conditions, the rings, new moons and the five inner moons are described. Titan, Hyperion and Iapetus are discussed in detail, as is Saturn's magnetosphere. S.F.

N81-12965*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JUPITER'S MAGNETOPAUSE, BOW SHOCK, AND 10-HOUR MODULATED MAGNETOSHEATH: VOYAGERS 1 AND 2
R. P. Lepping, L. F. Burlaga, and L. W. Klein Oct. 1980 21 p refs
(NASA-TM-82033) Avail: NTIS HC A02/MF A01 CSCL 03B

Fine scale magnetic field data from the Voyager 1 and 2 magnetopause and bow shock crossings at Jupiter were analyzed. Explicit models of the dawnside magnetopause and bow shock in Jupiter's orbital plane employ an axisymmetric parabola and hyperbola, respectively, and are determined separately for the encounters. A new phenomenon was discovered in the magnetosheath. It is manifested as (5 or) 10 hour quasi-periodic modulation of the direction of the magnetic field in the outbound magnetosheath, predominantly in the northward (N) and southward (S) directions. It was seen to occur during both encounters and appears most evident in Voyager 2 outbound observations, probably due to the extreme tailward extent of the Voyager 2 trajectory through the magnetosheath. The durations of the N to and from S transitions range from tens of minutes to approximately 3 hours. The directional variation of the field during these transitions is fairly well restricted to a plane parallel to the local model magnetopause location. These signatures may be due to magnetosheath field line draping modulated by the large scale motion of the magnetospheric plasma disk. A.R.H.

N81-12966*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FORMATION OF ARCS IN THE DYNAMIC SPECTRA OF JOVIAN DECAMETER BURSTS
Melvyn L. Goldstein and James R. Thieman (Ori, Inc., Silver Spring, Md.) Aug. 1980 34 p refs Submitted for publication
(NASA-TM-81987) Avail: NTIS HC A03/MF A01 CSCL 03B

A model is presented that can account for several features of the dynamic spectral arcs observed at decameter wavelengths by the planetary radio astronomy experiment on Voyagers 1 and 2. It is shown that refraction of an extraordinary mode wave initially excited nearly orthogonal to the local magnetic field is significantly influenced by the local plasma density, being greater the higher the density. It is assumed that the source of the decameter radiation lies along the L = 6 flux tube and that the highest frequencies are produced at the lowest altitudes, where both the plasma density and magnetic field gradients are largest. It is further assumed that the decameter radiation is emitted into a thin conical sheet, consistent with both observation and theory. In the model the emission cone angle of the sheet is chosen to vary with frequency so that it is relatively small at both high and low frequencies, but approximately 80 deg at intermediate frequencies. The resulting emission pattern as seen by a distant observer is shown to resemble the observed arc pattern. The model is compared and contrasted with examples of Voyager radio data. M.G.

N81-12967*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGETIC PARTICLES IN THE PRE-DAWN MAGNETOTAIL OF JUPITER
A. W. Schardt, F. B. McDonald, and J. H. Trainor Aug. 1980 61 p refs Submitted for publication
(NASA-TM-81991) Avail: NTIS HC A04/MF A01 CSCL 03B

A detailed account is given of the energetic electron and proton populations as observed with Voyagers 1 and 2 during their passes through the dawn magnetotail of Jupiter. The region between 20 and 150 R sub J is dominated by a thin plasma sheet, where trapped energetic electron and proton fluxes reach

their maximum. Proton spectra can be represented by an exponential in rigidity with a characteristic energy of approximately 50 keV. Proton anisotropies were consistent with corotation even at 100 R sub J. A major proton acceleration event as well as several cases of field aligned proton streaming were observed. The flux of > 0.4 MeV protons decreases by three orders of magnitude between 30 and 90 R sub J and then remains relatively constant to the magnetopause. Fine structure in the data indicate longitudinal asymmetries with respect to the dipole orientation. Electron spectra in the magnetosheath and interplanetary space are modulated by the Jovian longitude relative to the subsolar point. M.G.

N81-12968*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATIONS OF THE MAGNETIC FIELD AND PLASMA FLOW IN JUPITER'S MAGNETOSHEATH
R. P. Lepping, L. F. Burlaga, L. W. Klein, J. M. Jessen (MIT, Cambridge), and G. C. Goodrich (MIT, Cambridge) Nov. 1980 48 p refs
(NASA-TM-82035) Avail: NTIS HC A03/MF A01 CSCL 03B

Large scale (many minutes to 10 hours) magnetic field structures consisting predominantly of nearly north-south field direction were discovered in Jupiter's magnetosheath from the data of Voyagers 1 and 2 and Pioneer 10 during their outbound encounter trajectories. The Voyager 2 data, and that of Voyager 1 to a lesser extent, show evidence of a quasi-period of 10 hours (and occasionally 5 hours) for these structures. The north-south components of the field and plasma velocity were strongly correlated in the outbound magnetosheath as observed by Voyagers 1 and 2, and the components orthogonal to the north-south direction showed weak correlations. For both Voyager encounters the sense (positive and negative) of the north-south correlations were directly related to the direction of the ecliptic plane component of the interplanetary magnetic field using the field and plasma measurements of the non-encountering spacecraft. Author

N81-12969# Defense Mapping Agency, Washington, D.C.
SELENOCENTRIC CONTROL SYSTEM (1979) Final Report
Donald L. Meyer Apr. 1980 131 p refs
(AD-A090543; DMA/TR-80-001) Avail: NTIS HC A07/MF A01 CSCL 08/2

A catalog of 1156 lunar feature coordinates has been compiled from a reduction of original photographic plates taken by the U.S. Naval Observatory at Flagstaff, Arizona. A description of the observations, reductions and error determinations is presented. Also included is a catalog of about 750 limb positions which were derived in conjunction with the feature coordinates. GRA

N81-12970# National Technical Information Service, Springfield, Va.
MARS ENVIRONMENT. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1971 - Sep. 1980
Audrey S. Hundemann Sep. 1980 271 p Supersedes NTIS/PS-79/0974 and NTIS/PS-78/0940
(PB80-814999; NTIS/PS-79/0974; NTIS/PS-78/0940) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Research dealing with atmospheric and surface properties of Mars is discussed. A few abstracts pertain to instrumentation used in the space exploration. This updated bibliography contains 266 citations, 9 of which are new entries to the previous edition. GRA

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-12971 Institut d'Aeronomie Spatiale de Belgique, Brussels.
IMPULSIVE PENETRATION OF SOLAR WIND PLASMA AND ITS EFFECTS ON THE UPPER ATMOSPHERE
J. Lemaire 1979 33 p refs Presented at Sidney Chapman Conf. on Magnetospheric Boundary Layers, Alpbach, Austria, 11-15 Jun. 1979
(Aeronomica-Acta-A-207-1979) Avail: Issuing Activity

Impulsive penetration of solar wind plasma irregularities transfers energy, momentum, and particles into the magnetosphere. The effects on the upper atmosphere are examined and discussed. The heat deposition in the E region (and above) due to Joule dissipation of depolarization currents is evaluated and compared to the energy production due to the absorption of solar radiation. The wind speed imparted to ionospheric plasma in the throat region and over the polar cap is compared to the observed convection velocities. The impulsive injections of magnetosheath-like plasma observed at low altitudes in the dayside cusps are interpreted as consequences of field aligned expansions (spreadings) of engulfed solar wind filaments (intrusions) into the magnetosphere. Author (ESA)

N81-12972 Institut d'Aeronomie Spatiale de Belgique, Brussels.
OBSERVATION OF THE SOLAR ULTRAVIOLET RADIATION
P. C. Simon 1980 39 p refs Presented at NATO Adv. Study Inst. on Atmospheric Ozone, Albufeiras, Portugal, 2-13 Oct. 1979
(Aeronomica-Acta-A-211-1980) Avail: Issuing Activity

Ultraviolet solar irradiance observations of the Lyman alpha emission line and between 175 and 400 nm are reviewed and discussed. The uncertainties between the different measurements are pointed out and the discrepancies are discussed in terms of solar variability. Further observations are needed in order to determine accurately the absolute value of solar ultraviolet irradiation flux and its possible variation with the 11 year solar cycle. Author (ESA)

N81-12973*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE ORIGIN OF MULTIPLY-IMPULSIVE EMISSION FROM SOLAR FLARES Ph.D. Thesis
Judith Tobi Karpen Sep. 1980 181 p refs
(Grant NsG-033)
(NASA-TM-82013) Avail: NTIS HC A09/MF A01 CSCL 03B

A set of solar hard X-ray bursts observed with the hard X-ray burst spectrometer on board the OSO-5 satellite was analyzed. The multiply-impulsive two stage events were selected on the basis of both morphological characteristics and association with appropriate phenomena at other wavelengths. Coincident radio, soft X-ray, H-alpha interplanetary particle, and magnetographic data were obtained from several observatories, to aid in developing a comprehensive picture of the physical processes underlying these complex bursts. Two classes of multiply impulsive bursts were identified: events whose components spikes apparently originate in one location, and events in which groups of spikes appear to come from separate regions which flare sequentially. The origin of multiplicity in the case of a single source region remains unidentified. Purely impulsive emissions show no sign of betatron acceleration, thus eliminating this mechanisn as a candidate for inducing multiply spiked structure. The majority of the two stage bursts, however, exhibited spectral behavior consistent with the betatron model, for the first few minutes of the second stage. Betatron acceleration thus has been identified as a common second stage phenomenon. A.R.H.

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N81-12974*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DISCOVERY OF AN 81 MINUTE MODULATION OF THE X-RAY FLUX FROM 2A0311-227
N. E. White (Maryland Univ.) Nov. 1980 16 p refs Submitted for publication
(NASA-TM-82037) Avail: NTIS HC A02/MF A01 CSCL 03B

The X-ray flux from 2A0311-227 was modulated at the 81 min orbital period of its optical counterpart. An absorption dip with N sub H equivalent to 5 x 10 to the 22nd power H atoms per square cm was observed at magnetic phase 0.42. It was interpreted as the accretion column of a magnetic white dwarf passing in front of the X-ray source. The spectrum was thermal with a temperature of 18 keV and a 300 eV equivalent width iron line at 6.6 keV. Author

N81-12975*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SUPER-ALFVENIC PROPAGATION OF COSMIC RAYS: THE ROLE OF STREAMING MODES
Philip J. Morrison, John S. Scott, Gordon D. Holman, and James A. Ionson Oct. 1980 15 p refs
(NASA-TM-82032) Avail: NTIS HC A02/MF A01 CSCL 03B

Numerous cosmic ray propagation and acceleration problems require knowledge of the propagation speed of relativistic particles through an ambient plasma. Previous calculations indicated that self-generated turbulence scatters relativistic particles and reduces their bulk streaming velocity to the Alfven speed. This result was incorporated into all currently prominent theories of cosmic ray acceleration and propagation. It is demonstrated that super-Alfvenic propagation is indeed possible for a wide range of physical parameters. This fact dramatically affects the predictions of these models. Author

N81-12976*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTS ON THE EFFECT OF ULTRAVIOLET ON CONTAMINATION IN VACUUM SYSTEMS
Raymond Kruger and Harold Shapiro Aug. 1980 9 p
(NASA-TM-81999) Avail: NTIS HC A02/MF A01 CSCL 03B

A series of experiments designed to investigate the effect of irradiating a portion of a vacuum system with ultraviolet (UV) light are discussed. Data obtained with the quartz crystal microbalance show that, under ultraviolet irradiation, clean and contaminated mean different things than in situations that do not involve irradiation. The history of the chamber appears to be of paramount importance, not the pumping mechanism. UV irradiation check for contamination is recommended in critical experiments. M.G.

99 GENERAL

N81-12977*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RESEARCH AND TECHNOLOGY OF THE LANGLEY RESEARCH CENTER Annual Report, 1980
Nov. 1980 45 p
(NASA-TM-81910) Avail: NTIS HC A03/MF A01 CSCL 05B

Descriptions of the research and technology activities at the Langley Research Center are given. Topics include laser development, aircraft design, aircraft engines, aerodynamics, remote sensing, space transportation systems, and composite materials. M.G.

N81-12978*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPACT FOR THE 80'S: PROCEEDINGS OF A CONFERENCE ON SELECTED TECHNOLOGY FOR BUSINESS AND INDUSTRY
Nov. 1980 238 p Conf. held in Cleveland, 14-15 May 1980
(NASA-CP-2149; E-489) Avail: NTIS HC A11/MF A01 CSCL 05A

Various aspects of advanced energy technology are discussed. Specific emphasis is given to: aircraft propulsion; wind power commercialization; materials and structures, lubrication and bearings; Stirling and gas turbine engines; and electric and hybrid vehicles. For individual titles, see N81-12979 through N81-12991.

N81-12979*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY OVERVIEW **c44**
Henry O. Slone *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 1-9 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10A

The experience, capabilities, and facilities being utilized at NASA Lewis in support of energy programs conducted by the Department of Energy and other agencies are discussed. Background information is given regarding NASA's involvement in solving energy problems. R.C.T.

N81-12980*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA RESEARCH IN AEROPROPULSION **c07**
Warner L. Stewart *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 11-26 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 21E

The role of the Lewis Research Center in aeronautical propulsion is described. The state of the art in engine systems and components are discussed and some of the problems that confront the civil and military aeronautic sectors are addressed. Some of the programs that are under way are summarized with emphasis on the future needs and opportunities in aeronautics. R.C.T.

N81-12981*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE WIND TURBINES: A UTILITY OPTION FOR THE GENERATION OF ELECTRICITY **c44**
William H. Robbins, Ronald L. Thomas, and Darrell H. Baldwin *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 27-41 refs Also presented at the Am. Power Conf., Chicago, 21-23 Apr. 1980 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 10B

The economic and technical potential of wind energy in the United States is discussed. Particular attention is given to the status of wind turbine operational experience as well as the environmental posture of the technology. R.C.T.

N81-12982*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRESS IN MATERIALS AND STRUCTURES AT LEWIS RESEARCH CENTER **c23**
Thomas K. Glasgow, Richard W. Lauver, Gary R. Halford, and Robert L. Davies *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 43-64 refs (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 11G

The development of power and propulsion system technology is discussed. Specific emphasis is placed on the following: high temperature materials; composite materials; advanced design and life prediction; and nondestructive evaluation. Future areas of research are also discussed. R.C.T.

N81-12983*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THIN-FILM COATINGS **c26**
Donald H. Buckley *In its* Impact of the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 65-74 (For primary document see N81-12978 03-99)
Avail: NTIS HC A11/MF A01 CSCL 11F

Thin, adherent, high density films are discussed with respect to their application in two plasma physics techniques (ion plating and sputtering). The operation of each technique is described as well as what surfaces can be coated, and what kind of materials can be applied. The effects of these films on the mechanical properties of solid surfaces are also discussed. R.C.T.

N81-12984*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SELF-LUBRICATING COMPOSITE MATERIALS **c24**
Harold E. Sliney *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 75-95 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 11D

The mechanical properties of two types of self lubricating composites (polymer matrix composites and inorganic composites) are discussed. Specific emphasis is given to the applicability of these composites in the aerospace industry. R.C.T.

N81-12985*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROPULSION SYSTEM RESEARCH AND DEVELOPMENT FOR ELECTRIC AND HYBRID VEHICLES c85

Harvey J. Schwartz *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 97-103 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 13F

An approach to propulsion subsystem technology is presented. Various tests of component reliability are described to aid in the production of better quality vehicles. component characterization work is described to provide engineering data to manufacturers on component performance and on important component propulsion system interactions. R.C.T.

N81-12986*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE FEDERAL ELECTRIC AND HYBRID VEHICLE PROGRAM c85

Harvey J. Schwartz *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 105-109 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 13F

The commercial development and use of electric and hybrid vehicles is discussed with respect to its application as a possible alternative transportation system. A market demonstration is described that seeks to place 10,000 electric hybrid vehicles into public and private sector demonstrations. R.C.T.

N81-12987*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

JPL'S ELECTRIC AND HYBRID VEHICLES PROJECT: PROJECT ACTIVITIES AND PRELIMINARY TEST RESULTS c85

Thomas A. Barber *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 111-122 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 13F

Efforts to achieve a 100 mile urban range, to reduce petroleum usage 40% to 70%, and to commercialize battery technology are discussed with emphasis on an all plastic body, four passenger car that is flywheel assisted and battery powered, and on an all metal body, four passenger car with front wheel drive and front motor. For the near term case, a parallel hybrid in which the electric motor and the internal combustion engine may directly power the drive wheels, is preferred to a series design. A five passenger car in which the electric motor and the gasoline engine both feed into the same transmission is discussed. Upgraded demonstration vehicles were tested using advanced lead acid, nickel zinc, nickel iron, and zinc chloride batteries to determine maximum acceleration, constant speed, and battery behavior. The near term batteries demonstrated significant improvement relative to current lead acid batteries. The increase in range was due to improved energy density, and ampere hour capacity, with relatively small weight and volume differences. A.R.H.

N81-12988*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COAL GASIFIER COGENERATION POWERPLANT PROJECT c28

Lloyd I. Shure and Harvey S. Bloomfield *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 123-131 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 21D

Industrial cogeneration and utility pr systems were analyzed and a conceptual design study was conducted to evaluate the economic feasibility of a coal gasifier power plant for NASA Lewis Research Center. Site location, plant size, and electric power demand were considered in criteria developed for screening and selecting candidates that could use a wide variety of coals, including that from Ohio. A fluidized bed gasifier concept was chosen as the baseline design and key components of the powerplant were technically assessed. No barriers to environmental acceptability are foreseen. If funded, the powerplant will not only meet the needs of the research center, but will reduce the commercial risk for utilities and industries by fully verifying and demonstrating the technology, thus accelerating commercialization. A.R.H.

N81-12989*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE DOE PHOTOVOLTAICS PROGRAM c44

Robert R. Ferber *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 133-143 Sponsored in part by DOE (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 10A

As part of the National Solar Energy program, the US Department of Energy is now engaged in the development of technically feasible, low cost candidate component and system technologies to the point where technical readiness can be demonstrated by 1982. The overall strategy is to pursue parallel options that continue to show promise of meeting the program goals, thus increasing the probability that at least one technology will be successful. Included in technology development are both flat plate solar collectors and concentrator solar collectors, as well as the balance of system components, such as structures, power conditioning, power controls, protection, and storage. Generally, these last items are common to both flat plate and concentrator systems, but otherwise there is considerable disparity in design philosophy, photovoltaic cell requirements, and possible applications between the two systems. Objectives for research activities at NASA Lewis for stand alone applications, and at Sandia Laboratories where intermediate load center applications are addressed, are highlighted as well as college projects directed by Oak Ridge National Laboratory, and international applications managed by the Solar Energy Research Institute. Joint DOD/DOE effects for military applications are also summarized. A.R.H.

N81-12990*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLAR PHOTOVOLTAICS: STAND ALONE APPLICATIONS c44

James N. Deyo *In its* Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 145-156 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 10A

The Lewis Research Center involvement in space photovoltaic research and development and in using photovoltaics for terrestrial applications is described with emphasis on applications in which the normal source of power may be a diesel generator, batteries, or other types of power not connected to a utility grid. Once an application is processed, technology is developed and demonstrated with a user who participates in the cost and furnishes the site. Projects completed related to instruments, communication, refrigeration, and highways, are described as well as warning systems, weather stations, fire lookouts, and village power systems. A commercially available photovoltaic powered electric fence charger is the result of Lewis research and development. A.R.H.

N81-12991*# *TRW Defense and Space Systems Group, Redondo Beach, Calif.*

MATERIALS PROCESSING IN SPACE: FUTURE TECHNOLOGY TRENDS c12

Neville J. Barter *In* NASA. Lewis Research Center Impact for the 80's: Proc. of a Conf. on Selected Technol. for Business and Ind. Nov. 1980 p 159-177 (For primary document see N81-12978 03-99)

Avail: NTIS HC A11/MF A01 CSCL 22A

NASA's materials processing in space- (MPS) program involves both ground and space-based research and looks to frequent and cost effective access to the space environment for necessary progress. The first generation payloads for research are under active design and development. They will be hosted by the Space Shuttle/Spacelab on Earth orbital flights in the early 1980's. hese missions will focus on the acquisition of materials behavior research data, the potential enhancement of

Earth based technology, and the implementation of space based processing for specialized, high value materials. Some materials to be studied in these payloads may provide future breakthroughs for stronger alloys, ultrapure glasses, superior electronic components, and new or better chemicals. An operational 25 kW power system is expected to be operational to support sustained, systematic space processing activity beyond shuttle capability for second generation payload systems for SPACELAB and free flyer missions to study solidification and crystal growth and to process metal/alloys, glasses/ceramics, and chemicals and biologicals. A.R.H.

N81-12992# *European Space Agency, Paris (France).*
ACTIVITIES OF THE SPACE SCIENCE DEPARTMENT IN 1978/1979 Annual Report
D. E. Page, comp., B. Fitton, comp., A Pedersen, comp., B. G. Taylor, comp., K. P. Wenzel, comp., W. R. Burke, ed., and J. Mort, ed. Sep. 1980 74 p refs
(ESA-SP-1032; ISSN-0379-6566) *Avail: NTIS* HC A04/MF A01

The organizational structure, scientific personnel and visitors and a list of the main scientific topics being dealt with, in each of the four divisions of the Space Science Department are presented. These divisions are cosmic rays, space plasma physics, astronomy, and high energy astrophysics. The publications of each division are listed. NASA-ESA cooperative programs are mentioned. Author (ESA)

N81-12993# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
TESTING AND MEASUREMENT TECHNIQUES IN HEAT TRANSFER AND COMBUSTION
Sep. 1980 281 p refs Presented at the 55th(A) Specialist Meeting of the AGARD Propulsion and Energetics Panel, Brussels, 5-7 May 1980
(AGARD-CP-281; ISBN-92-835-0272-8) Avail: NTIS HC A13/MF A01

Recent advances in temperature measurements, flow measurements, composition, and chemical measurements were discussed in order to furnish a comprehensive survey of modern test rigs and measurement techniques to development engineers for combustors and other high temperature components and to provide research scientists in these areas with recently developed techniques. Topics include: engine related measuring techniques; heat transfer for measurement techniques; optical velocity measurement techniques in flames; and optical techniques for temperature and composition measurements. For individual titles, see N81-12994 through N81-13015.

N81-12994# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
PROBLEM IN THE MEASUREMENT OF METAL TEMPERATURE, GAS TEMPERATURE, HEAT FLUX AND STRAIN IN COMBUSTORS AND TURBINES **c07**
W. G. Alwang *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 9 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

The verification of a gas turbine engine design requires that all critical design parameters be measured as directly and accurately as possible during development testing. The hot section of the engine poses some particularly difficult measurement problems. The imitations of current instrumentation used in the combustor and turbine are described and work in progress to overcome these limitations is reviewed. Among the topics to be covered are: limitations on the use of advanced dual spectral range optical pyrometers for metal surface temperature measurement, use of sputtered thin film thermocouples, problems in measuring gas temperature distributions and burner pattern factor, particularly above 3000 F, problems in measuring static strain and strain range in hot section hardware, and problems in the measurement of radiative and total heat flux. E.D.K.

N81-12995# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
TECHNICAL SUPPOSITIONS DEVELOPED FOR SMOKE MEASUREMENTS DURING HIGH PRESSURE FULL ANNULAR COMBUSTOR TESTS AND ENGINE TRIALS **c07**
G. Kappler, J. Seyboth, and G. Huster *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

The knowledge of smoke emissions from jet engines is of interest for civil as well as for military engine applications. Smoke emission measurements are a necessary and reliable tool for low emission combustor development. Two measuring techniques were designed: one for reliable cross correlations and basic calibrations using stained filter paper and another for fast continuous measurements based on an optical extinction method. The measuring systems are described and cross correlation data with a sucked Hartridge smoke meter is presented. Also covered are the sampling probes developed. Analysis of results of smoke emission measurements from three combustors with different smoke suppression methods showed good accuracy and reproducibility of the incorporated measuring systems. E.D.K.

N81-12996# Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France).
STUDYING THE EXHAUST GAS FROM A POST COMBUSTION TURBOJET ENGINE [ETUDE DES GAZ DECHAPPEMENT DUN TURBOREACTERUR EN RECHAUFFE] **c07**
Ph. Gastebois and S. Ropars *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p In FRENCH Prepared in cooperation with Centre d'Essaisdes Propulseurs, Saclay, France (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Knowledge of local temperatures and of the concentrations of pollutant species in the jet of a turbojet engine is useful for optimizing post combustion efficiency and for evaluating the importance of the air pollution created by the engine. A means is presented for analyzing gas removed by separator from the blast pipe of an OLYMPUS engine both on the ground and in simulated altitude. Results obtained show the difficulty of fixing the composition of gas taken before analysis and the necessity of improving techniques for measuring high temperature exhaust gases. A.R.H.

N81-12997# Cornell Univ., Ithaca, N. Y. Sibley School of Mechanical and Aerospace Engineering.
PROBE MEASUREMENTS IN MULTI-DIMENSIONAL REACTING FLOWS **c34**
F. C. Gouldin *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 14 p refs (For primary document see N81-12993 03-99)
(Grant NSG-3019)
Avail: NTIS HC A13/MF A01

The time mean response of pressure and sampling probes to pressure, density, and velocity fluctuations in turbulent reacting flows is examined by averaging over the instantaneous probe response. Corrections for fluctuation effects are found to be necessary if data obtained by these probes are to be used to find mean velocity and concentration information. Correction terms for pressure probe readings are well founded and of general applicability, while sampling probe correction terms are well founded only if the sample flow is choked at the probe inlet, a state which may be difficult to achieve in practice. Also, probe induced flow field perturbations are discussed for measurements in swirling flow. It is recommended that to avoid perturbations the smallest possible probes be used and that combustion conditions be monitored, e.g., with wall pressure taps, during probe insertion in order to detect perturbations should they occur. E.D.K.

N81-12998# Kraftwerk Union A.G., Mulheim (West Germany).
APPLICATION OF MODEL LAWS WHEN DETERMINING THE HEAT TRANSFER COEFFICIENTS BY EXPERIMENTS ON COOLED TURBINE BLADES **c07**
O. A. vonSchwerdtner and H.-G. Hosenfeld *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Model laws were fulfilled for geometry, aerodynamics, and heat transfer by reducing temperature and pressure of the operational and cooling fluids as opposed to the conditions in

the turbine. The conception of a cascade wind tunnel with closed circuit enables the independent variation of influence values, e.g., Mach no. and Reynolds no., degree of turbulence and temperature ratio operating fluid/cooling fluid. Two measuring methods used were: (1) determining the local heat transfer coefficients by calorimetric means when cooling the blade surface with water in sections and (2) distribution of the cooling efficiency on the profile contour with the original cooling process. E.D.K.

N81-12999# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

HEAT TRANSFER MEASUREMENTS RELATED TO HOT TURBINE COMPONENTS IN THE VON KARMAN INSTITUTE HOT CASCADE TUNNEL c07

B. E. Richards *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

The hot cascade tunnel developed to extend turbine research to heat transfer studies is described. It is based on a free piston compressor of 1 meter in diameter and 5 meters in length with a test section of 100 mm x 250 mm compatible with an existing ambient temperature blowdown cascade tunnel. Some typical results on heat transfer and film cooling from the first 1200 tests are described. E.D.K.

N81-13000# Oxford Univ. (England). Dept. of Engineering Science.

HEAT TRANSFER RATE AND FILM COOLING EFFECTIVENESS MEASUREMENTS IN A TRANSIENT CASCADE c34

D. L. Schultz, M. L. G. Oldfield, and T. V. Jones *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 9 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

A transient cascade useful for heat transfer rate measurements is briefly described. The facility employs a free piston which compresses the test gas to temperatures around 450 K and pressures of about 3.5 to 7.5 Atm. The model is initially at room temperature and it is necessary to attain the correct gas to wall temperature ratio. The exit Mach number is set by the inlet total pressure and the pressure in the exit dump tank. Thin film heat transfer gauges are used for the measurement of heat transfer rate, deposited on machineable glass ceramic blades. The inherently fast response of these transducers makes them useful for the investigation of boundary layer transition on blade surfaces and some typical results are included. E.D.K.

N81-13001# Sussex Univ., Brighton (England). Dept. of Mechanical Engineering.

STUDIES OF TURBULENCE CHARACTERISTICS AND THEIR EFFECTS UPON THE DISTRIBUTION OF HEAT TRANSFER TO TURBINE BLADING c07

F. J. Bayley and W. J. Priddy *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 15 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

Two techniques are used to determine the distribution of heat transfer coefficient around turbine blade sections. Data are reported from cascade tests with a steady mainstream and then from tests in which the turbulence intensity and frequency were systematically varied. A provisional correlation of the data is described. E.D.K.

N81-13002# Karlsruhe Univ. (West Germany). Engler-Bunte-Institut.

CORRELATION MEASUREMENT OF VELOCITY AND TEMPERATURE FLUCTUATIONS IN A FREE JET DIFFUSION FLAME c25

V. Wittmer and R. Guenther *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 8 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

A free jet diffusion flame was studied. The measurement techniques used were the laser Doppler anemometry (LDA) and a compensated thermocouple. With LDA the fields of both the mean axial and radial velocities and their fluctuations were measured. The local mean and fluctuating temperature were measured after determining the frequency response. The time constant was measured assuming the transfer function of the thermocouple to be a first order lag. The results of the temperature measurement show that the maximum of the temperature fluctuations is outside of the reaction zone. In a transverse plane, the correlation of the fluctuating axial and radial velocities has the maximum at the location of the highest gradient of the axial velocity. The correlation of fluctuating velocity and temperature becomes zero in the reaction zone. E.D.K.

N81-13003# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.

VELOCITY AND TURBULENCE MEASUREMENTS IN TURBULENT FLAMES USING THE L2F TECHNIQUE c25

H. Eickhoff and R. Schodl *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

The flow properties within turbulent diffusion flames were measured using an L2F velocimeter. Considering the problem of seeding, some basic investigations were carried out within a round free jet. The optically measured mean velocity and turbulence intensities were compared with pitot tube and hot wire data respectively. The results which are presented and discussed indicate the capability of the L2F velocimeter when it is applied to highly turbulent flows. Mean velocity and turbulence were measured in hydrogen air and propane air diffusion flames under different initial conditions. The results are discussed with regard to the influence of combustion on the turbulent flow field. E.D.K.

N81-13004# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

VELOCITY MEASUREMENT TECHNIQUES IN LIQUID SPRAYS USING LASER DOPPLER VELOCIMETRY c34

M. L. Riethmuller and J.-M. Buchlin *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 7 p refs (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

In many applications, there exists a velocity lag between droplets and a surrounding gas. The measurement of gas velocity must therefore be performed separately from the measurement of droplet velocity. This is the objective of a technique implemented in order to measure gas velocity, in the presence of droplets. A laser velocimeter adjusted for reference beam mode was used in a water spray. Satisfactory results are obtained and it is shown that, providing the gas flow is correctly seeded with small particles, a velocity measurement of gas velocity is yielded even with a large number of droplets. E.D.K.

N81-13005# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).

A METHOD FOR MEASURING SHORT TIME RESPONSE BY DETERMINING VELOCITY AND TEMPERATURE VARIATIONS IN HIGH TEMPERATURE FLOWS [METHODES DE MESURE A COURT TEMPS DE RESPONSE POUR LA DETERMINATION DES FLUCTUATIONS DE VITESSE ET TEMPERATURE DANS LES ECOULEMENTS A TEMPERATURE ELEVEE] c35

Marc Chardenel, Yves LeBot, Philippe Magre, Jean Labbe, and Pierre Moreau *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 13 p refs In FRENCH; ENGLISH summary (For primary document see N81-12993 03-99)

Avail: NTIS HC A13/MF A01

An optical device using an infrared simultaneous emission and absorption method for measurements of instantaneous gas temperatures, and total pressure probes with a short response time in order to measure the turbulence level were developed to characterize the unsteadiness of high temperature flows. These two experimental techniques are described and the results obtained on hot turbulent flows are analyzed and compared with more classical indications given by laser velocimetry. The further application of these techniques to obtain the turbulence spectra and to determine the integral scale by the optical method of crossed beams is also examined Author

N81-13006# Imperial Coll. of Science and Technology, London (England).
VELOCITY AND TEMPERATURE MEASUREMENTS IN A PREMIXED FLAME WITHIN AN AXISYMMETRIC COMBUSTOR **c25**
A. M. K. P. Taylor and J. H. Whitelaw *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 11 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Measurements of velocity, temperature, and noise characteristics are reported for a premixed natural gas, air flame stabilized on a disc baffle located on the axis of a round pipe and for a corresponding isothermal flow. The stability limits of the flame are identified, and measurements of mean axial velocity, the variance of the corresponding fluctuations, and noise intensity are provided for equivalence ratios in the range 0.7 to 1.6. Center line distributions of mean axial velocity, the variance of the corresponding fluctuations, and mean temperature are reported and an analysis presented of the uncertainties of the laser anemometer instrumentation and bare wire thermocouple measurements. It is shown that: the range of equivalence ratios which allow stable combustion is comparatively small; that the maximum and minimum mean velocities and the length of the recirculation region are increased by combustion; and that the center line distribution of mean temperature is comparatively uniform for more than 3 baffle diameters downstream. E.D.K.

N81-13007# Sussex Univ., Brighton (England). School of Engineering and Applied Sciences.
THE USE OF OPTICAL TECHNIQUES IN THE INTERPRETATION OF HEAT TRANSFER MEASUREMENTS **c74**
J. M. Owen and J. R. Pincombe *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 12 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Optical techniques were used to study the flow structure, and to gain a better understanding of the convective heat transfer inside rotating cavities. Flow visualization was used to determine the amount of coolant necessary to seal an air cooled rotor stator system, to delineate regimes of vortex breakdown in rotating cavities with axial throughflow, and to identify the flow regimes in a rotating cavity with a radial outflow of coolant. The LDA measurements of the radial and tangential components of velocity inside the rotating cavity were used to correlate the flow visualization results. For the radial outflow case, these velocity measurements are in good agreement with theoretical predictions. Measured Nusselt numbers reveal the presence of heat transfer regimes corresponding to those identified by the optical techniques. E.D.K.

N81-13008# Poitiers Univ. (France). Lab. d'Energetique et de Detonique.
THE APPLICATION OF UV SPECTROSCOPY TO THE QUANTITATIVE ANALYSIS OF NITROGEN OXIDE [APPLICATION DE LA SPECTROSCOPIE U. V. AU DOSAGE DE LOXYDE NITRIQUE] **c25**
J. Ph. Durand and J. C. Bellet *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 10 p refs In FRENCH (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Measurements of nitrogen oxide concentration in combustion products, obtained under very different experimental conditions, by ultraviolet absorption spectrometry and by sampling and quantitative analysis using a chemiluminescence analyzer were compared. Results demonstrate that parasitic absorptions of oxygen and anhydrous carbon must be considered when the temperature exceeds about 700 K for the (1,0) gamma band, and 900 K for the (0,0) gamma band. In addition, measurements made in the jet of a turbojet engine at the SMECMA test stand show that other parasitic species not yet identified, but probably incombustibles, interfere with measurements.
Transl. by A.R.H.

N81-13009# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
DIAGNOSING COMBUSTION BY D.R.A.S.C. [DIAGNOSTICS DES COMBUSTIONS PAR D.R.A.S.C.] **c25**
B. Attal, M. Pealat, and J. P. Taran *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 16 p refs In FRENCH (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

The coherent anti-Stokes Raman spectrometers (DRASC) used at ONERA are described. The nonresonating instrument permits the use of the BOXCARS technique and eliminates the nonresonating base. Its spectral resolution of 0.7 cm/1 can be reduced to 0.07 c/1 by the simple placement of an optical element and no realignment. A wide band operational mode is also forseen for multiplex spectroscopy. Some characteristic results obtained in a furnace simulating a turbomachine are presented. Detectability is generally between 100 and 1000 ppm. Recent results on iodine give hope that gains in detectability between 100 and 1000 will be possible with the resonating DRASC. A.R.H.

N81-13010*# United Technologies Research Center, East Hartford, Conn.
INVESTIGATIONS OF COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) FOR PRACTICAL COMBUSTION DIAGNOSTICS **c25**
Alan C. Eckbreith, Robert C. Hall, and John A. Shirley *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 14 p refs Sponsored in part by NASA and EPA (For primary document see N81-12993 03-99)
(Proj. SQUID)
Avail: NTIS HC A13/MF A01 CSCL 21B

Coherent anti-Stokes Raman spectroscopy (CARS appears very promising for the remote, spatially and temporally precise probing of instrumentally hostile combustion environments due to its large signal conversion efficiency and coherent signal nature. By analyzing the spectral distribution of the CARS signal, temperature measurements can be performed. Species concentration measurements derive from the intensity of the CARS radiation or, in certain cases, from its spectral shape. The CARS spectra were recorded in a variety of flames from N2, O2, CO, H2, H2O, CO2 and CH4 and, for the first five generally show very good agreement with computer synthesized spectra. Quite significantly, CARS was successfully demonstrated with both liquid and gaseous fuels in the primary zone and exhaust of practical combustors. Although thermometry has received the major emphasis, species concentration measurements were performed for H2, O2, and CO. E.D.K.

N81-13011# General Electric Co., Schenectady, N. Y. Corp. Research and Development.
THE STUDY OF TURBULENT DIFFUSION FLAMES: MODELING NEEDS AND EXPERIMENTAL LIGHT SCATTERING CAPABILITIES **c25**
M. Ladd and R. M. C. So *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 18 p refs Sponsored in part by DOE and AFOSR (For primary document see N81-12993 03-99)
(Proj. SQUID)
Avail: NTIS HC A13/MF A01

The capabilities of advanced light scattering measurement techniques are compared with the needs of combustion modeling approaches. Such comparisons are useful in working toward the coupled goals of developing and verifying flame models and providing guidance for the development of experimental probe methods along the most productive paths. The types of experimental data available are compared with those often required in combustion modeling, permitting one to assess the present and potential contributions of the techniques. This assessment is illustrated by consideration of current analytical results based upon Pratt's coalescence/dispersion model, and by recent experimental results from Raman scattering diagnostics of turbulent diffusion flames. The experimental data shown include simultaneously determined values of temperature and major species densities and are presented in the form of pdf's and density-temperature correlations. E.D.K.

N81-13012# Consiglio Nazionale delle Ricerche, Milan (Italy).
FLAME TEMPERATURE PROFILES OBTAINED BY THE TWO-LINE ATOMIC FLUORESCENCE METHOD **c25**
G. Zizak, F. Cignoli, and S. Benecchi *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 8 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Flame temperature measurements performed using the two line atomic fluorescence method (TLAF) are described. Several flames were investigated and it is concluded that when a lamp is used, the measuring times for many important flames are much too long. Hence, in actual combustion systems, difficulties arise which may not be easily solved. If a source with higher energy (i.e. a laser) becomes necessary, other techniques are preferable. E.D.K.

N81-13013# Sandia Labs., Livermore, Calif.
APPLICATIONS OF OPTICAL DIAGNOSTIC TECHNIQUES IN COMBUSTION RESEARCH **c25**
D. L. Hartley and M. A. Gusinow *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 15 p refs (For primary document see N81-12993 03-99)
(Contract DE-AC04-76DP-00789)
Avail: NTIS HC A13/MF A01

A summary of the application of laser based optical techniques to the diagnostics of combustion problems is presented. The emphasis was on the determination of temperature and species concentrations in a combusting environment. The application of these techniques centered on laminar flames, turbulent flames, particulate laden flows, and internal combustion engines. The constraints of spatial and temporal resolution were achieved, as well as the detection of intermediate species in certain laboratory experiments. E.D.K.

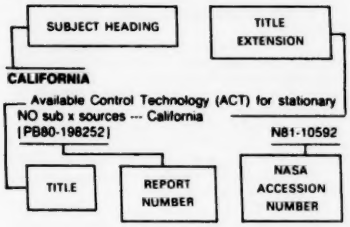
N81-13014# National Center for Energetics and Propulsion, Milan (Italy).
DROPLET SIZE MEASUREMENTS IN COMBUSTION BY THE VISIBILITY METHOD **c25**
A. Coghe, C. Brioschi, F. Gamma, and U. Ghezzi *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 10 p refs Prepared in cooperation with Politecnico di Milano (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

Droplet size measurements in a flame of liquid fuel sprays by means of the visibility method is based on the classical LDV optical system, which makes it possible to extract size information from the visibility of the scattered signal generated by a single droplet crossing the probe volume. The purposes of this paper are: (1) to present basic principles and numerical results of the theoretical model based on Mie scattering; (2) to present results obtained by experimental tests performed on liquid fuel sprays under burning conditions; and (3) to discuss the reliability and the limits of this method, its sensitivity, and an improved data processing procedure. E.D.K.

N81-13015# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).
A METHOD FOR THE MEASUREMENTS OF MIXING PROPERTIES IN A FLOW **c34**
C. Borrego and D. Olivari *In* AGARD Testing and Meas. Tech. in Heat Transfer and Combust. Sep. 1980 16 p refs (For primary document see N81-12993 03-99)
Avail: NTIS HC A13/MF A01

A laser Doppler velocimeter (LDV) and a laser scatter meter (LSM) were used to measure flow velocity and tracer concentration. Tests were carried out on a turbulent air jet of circular cross section exhausting into still air. The method for measuring certain parameters relevant to the mixing process was tested involving laser equipment in combination with the introduction of a tracer in the jet in the form of oil smoke. The flow field was examined at locations varying from two to twenty diameters downstream of the nozzle. Main parameters recorded at each downstream station were: mean axial velocity, mean concentration, fluctuating velocity, and concentration and velocity-concentration correlation. E.D.K.

Typical Subject Index Listing



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A

ABSORPTANCE
Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401

ABSORPTION CROSS SECTIONS
Line shapes in laser experiments
[AD-A090766] N81-12415

Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12847

ABSORPTION SPECTROSCOPY
The application of UV spectroscopy to the qualtitative analysis of nitrogen oxide N81-13008

ABUNDANCE
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958

ACCELEROMETERS
BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128

BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129

BIRAMIS: Numerical evaluation of the overall system precision --- radiation balance measurements by satellite-borne microaccelerometer
[ONERA-RT-7/3373-SY] N81-12159

Proposals to use micro-accelerometers for space geodetic experiments
[ESA-CR(P)-1371] N81-12160

ACETATES
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912

ACID RAIN
Proceedings of the International Workshop of the Effects of acid precipitation vegetation, soils, and terrestrial ecosystems
[BNL-51195] N81-12661

Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663

ACOUSTIC ATTENUATION
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440

Acoustic transmission matrix of a variable area duct or nozzle carrying a compressible subsonic flow
[NASA-TM-81614] N81-12821

ACOUSTIC EMISSION
Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070

Acoustic emission of carbon fiber reinforced plastics
[FOK-R-2464] N81-12250

Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440

ACOUSTIC EXCITATION
Spacecraft structural acoustic studies. Investigation, interpretation, and simulation of the effects of configuration features on noise. Induced structural vibration and sound transmission characteristics
[BAE-ESA/B44/40013] N81-12472

ACOUSTIC FATIGUE
Sonic fatigue design techniques for advanced composites aircraft structures
[AD-A090553] N81-12069

ACOUSTIC MEASUREMENTS
Acoustic emission of carbon fiber reinforced plastics
[FOK-R-2464] N81-12250

Looking for heavier weak bosons with DUMAND
[NASA-TM-82027] N81-12828

ACOUSTIC PROPAGATION
Spacecraft structural acoustic studies. Investigation, interpretation, and simulation of the effects of configuration features on noise. Induced structural vibration and sound transmission characteristics
[BAE-ESA/B44/40013] N81-12472

Parametric acoustic conversion-efficiency enhancement via boundary induced and inherent dispersivity
[AD-A090329] N81-12823

ACOUSTIC VELOCITY
Fast deflagration waves
[AD-A090776] N81-12190

ACOUSTICS
Atmospheric echo sounding. Citations from the NTIS data base
[PB80-815004] N81-12694

Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719

Transonic rotor noise - theoretical and experimental comparisons
[AD-A090806] N81-12824

ACRYLIC RESINS
Direct-write ion lithography
[AD-A090607] N81-12397

ACTIVE CONTROL
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113

ACTUATORS
Sensor/actuator failure detection for turbofan engines N81-12104

ADAPTATION
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380

ADAPTERS
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444

ADAPTIVE CONTROL
Propulsion Controls, 1979 --- air breathing engine control
[NASA-CP-2137] N81-12090

Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096

Road map to adaptive optimal control --- jet engine control N81-12098

Engine identification for adaptive control N81-12100

Closed loop control systems: Aircraft. Citations from the NTIS data base
[PB80-813710] N81-12114

Antenna sidelobe and interference reduction. Citations from the NTIS data base
[PB80-815186] N81-12322

ADDITIVES
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189

ADHESIVE BONDING
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081

The improvement of external lead bond and flexure strengths by comparing lead base materials
[BDX-613-2339] N81-12219

Aircraft surface coatings study: Energy efficient transport program --- sprayed and adhesive bonded coatings for drag reduction
[NASA-CR-158954] N81-12225

Bonding silicons with epoxies
[BDX-613-2432] N81-12240

Use of ultra-light adhesive for metal honeycomb bonding --- in satellite panels
[SNIAS-801-422-104] N81-12247

Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249

ADHESIVES
Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252

ADSORPTION
Surface and catalysis science in the Materials and Molecular Research Division
[DOE/TIC-11225] N81-12202

The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569

Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904

Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915

AERIAL PHOTOGRAPHY
Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508
Detection of signal signatures of cartographic features
[AD-A090375] N81-12531
Stratospheric layering photographed --- from a balloon gondola
[AERONOMICA-ACTA-C-54-1979] N81-12674
AERODYNAMIC CHARACTERISTICS
A computer program to calculate the longitudinal aerodynamic characteristics of upper-surface-blown wing-flap configurations
[NASA-CR-3005] N81-12014
A mathematical model of the CH-53 helicopter
[NASA-TM-81238] N81-12065
Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) --- Lewis 9 by 15 foot low speed wind tunnel tests
[NASA-TP-1178] N81-12084
Some new research approaches to aircraft spin studies
[AAAF-NT-80-12] N81-12112
Surface effect vehicles and surface effect: General studies. Citations from the NTIS data base
[PB80-814551] N81-12294
Surface effect vehicles/ships in Marine environments. Citations from the Engineering Index data base
[PB80-814510] N81-12295
Application of a method for aerodynamic analysis and design of horizontal axis wind turbines, part 1
[FFA-TN-AU-1499-PT-1] N81-12633
AERODYNAMIC CONFIGURATIONS
Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body
[NASA-CR-163795] N81-12140
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
AERODYNAMIC DRAG
Induced drag ideal efficiency factor of arbitrary lateral-vertical wing forms
[NASA-CR-3357] N81-12022
Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mchawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044
Improved methods for computing drag corrected missile impact predictions in real time
[AD-A090413] N81-12145
AERODYNAMIC LOADS
Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074
AERODYNAMIC STABILITY
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds
[AD-A090443] N81-12027
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115
Stability of large horizontal-axis axisymmetric wind turbines
[NASA-TM-81623] N81-12446
AERODYNAMIC STALLING
Experiments on an airfoil at high incidence in plunging motion
[AAAF-NT-80-09] N81-12030
AERODYNAMICS
Aeronautical engineering. A continuing bibliography with indexes, supplement 127, October 1980
[NASA-SP-7037(127)] N81-12011
Optimal regulation in systems with stochastic time sampling
[NASA-TP-1743] N81-12812
AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935
AEROELASTICITY
Unsteady aerodynamics inputs for aeroelastic analyses. Part A: A general introduction. Part B: Prediction of the unsteady airloads on oscillating lifting systems and bodies in subsonic and supersonic flow
[DFVLR-MITT-80-01] N81-12035
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448
Aeroelastic optimization with multiple constraints
[AD-A090775] N81-12451
AERONAUTICAL ENGINEERING
Aeronautical engineering. A continuing bibliography with indexes, supplement 127, October 1980
[NASA-SP-7037(127)] N81-12011
NASA authorization, 1982 (program review), volume 1
[GPO-68-972] N81-12938
Aeronautics and Space Report of the President, 1979 activities N81-12956
AERONOMY
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679
AEROSPACE ENGINEERING
Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170
Flammability testing --- aerospace materials
[ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide --- aerospace materials
[ESA-STM-213] N81-12251
AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935
Research and technology of the Langley Research Center
[NASA-TM-81910] N81-12977
AEROSPACE ENVIRONMENTS
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
[DS-ERT-14/80] N81-12381
AEROSPACE MEDICINE
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 211, October 1980
[NASA-SP-7011(211)] N81-12723
AEROSPACE SCIENCES
Activities of the Space Science Department in 1978/1979
[ESA-SP-1032] N81-12992
AEROSPACE TECHNOLOGY TRANSFER
Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725
Aeronautics and Space Report of the President, 1979 activities N81-12956
AEROSPACE VEHICLES
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
AEROTHERMOCHEMISTRY
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
AEROTHERMODYNAMICS
Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body
[NASA-CR-163795] N81-12140
AFRICA
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500
Study of the operational deployment of SIRIO-2 ground stations, volume 3 --- meteorological data distribution
[ESA-CR(P)-1369-VOL-3] N81-12713
AFTERBURNING
Studying the exhaust gas from a post combustion turbojet engine N81-12996
AGING (MATERIALS)
Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252
AGRICULTURAL AIRCRAFT
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
AGRICULTURE
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
Remote sensing of agricultural resources. Citations from the NTIS data base
[PB80-814981] N81-12541
Agricultural waste products as alternative energy sources
[GPO-62-991] N81-12561
Energy research and extension
[GPO-61-544] N81-12562
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649
AGRISTARS PROJECT
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
Minimum variance geographic sampling
[E81-10033] N81-12515
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Contextual classification of multispectral image data: Approximate algorithm
[E81-10038] N81-12520
AGROMETEOROLOGY
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707
AIR
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873
AIR BREATHING ENGINES
Propulsion Controls, 1979 --- air breathing engine control
[NASA-CP-2137] N81-12090
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C --- air breathing engines
[NASA-CR-159794] N81-12227
AIR CARGO
Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039
AIR FLOW
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192
Surface effect vehicle/ships in Marine environments. Citations from the NTIS data base
[PB80-814528] N81-12293
The use of the finite element method in meteorological modelling
[AD-A090761] N81-12700

AIR INTAKES
Experimental and numerical study of flow in air intakes at high incidences
[AAAF-NT-80-19] N81-12031
AIR JETS
Turbulent mixing and concentration measurement
[VKI-PREPRINT-1980-8] N81-12377
A method for the measurements of mixing properties in a flow N81-13015
AIR LAND INTERACTIONS
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
AIR POLLUTION
A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405
Analysis of air quality management with emphasis on transportation sources
[NASA-CR-163746] N81-12647
Clean air act-amendments of 1977: Oversight
[GPO-63-136] N81-12648
USAF Aircraft Engine emission goals, a critical review
[AD-A090282] N81-12651
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652
Planetary-wave behavior and arctic air pollution
[DOE/EV-01340/T2] N81-12657
Measuring particulate air pollution
[IG-PUBL-638] N81-12664
Air quality monitoring. Citations from the NTIS data base
[PB80-813462] N81-12665
Report to the National Commission of Air Quality on the benefit methodology evaluation panel
[PB80-208390] N81-12668
Studying the exhaust gas from a post combustion turbojet engine N81-12996
AIR QUALITY
Carbon dioxide effects research and assessment program. A comprehensive plan. Part 1: The global carbon cycle and climatic effects of increasing carbon dioxide
[DOE/EV-0094] N81-12201
Analysis of air quality management with emphasis on transportation sources
[NASA-CR-163746] N81-12647
Summary of pacific missile test center meteorological support Air Quality Assessment Model (AQAM) tests at the Naval Air Station, Mirimar, 1 to 8 August 1979
[AD-A090529] N81-12650
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652
In pursuit of clean air: A data book of problems and strategies at the state level. Volume 3: Federal regions 4 and 6
[ANL/EES-TM-90-VOL-3] N81-12656
Air quality monitoring. Citations from the NTIS data base
[PB80-813462] N81-12665
Air quality monitoring. Citations from the NTIS data base
[PB80-813470] N81-12666
AIR TRAFFIC
Airport and airspace delay model description
[AD-A090781] N81-12049
AIR TRAFFIC CONTROL
Aviation safety
[GPO-68-717] N81-12040
IFR aircraft handled forecast by air route traffic control center, fiscal years 1980-1991
[AD-A090803] N81-12048
Airport and airspace delay model description
[AD-A090781] N81-12049
Air traffic controllers and flight service station specialists
[GPO-51-381] N81-12055
AIR TRAFFIC CONTROLLERS (PERSONNEL)
Air traffic controllers and flight service station specialists
[GPO-51-381] N81-12055
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech
[RAE-TM-FS-334] N81-12737
AIR TRANSPORTATION
Clear air turbulence. Citations from the NTIS data base
[PB80-814825] N81-12716
Aeronautics and Space Report of the President, 1979 activities N81-12956
AIR WATER INTERACTIONS
Further study of the variability in the frequency of typhoon formation over the West Pacific ocean
[COO-1340-75] N81-12702
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703
AIRBORNE/SPACEBORNE COMPUTERS
Reliable software: Standards for the production of high quality systems --- esa satellites
[ESA-CR(P)-1358] N81-12770
AIRCRAFT ACCIDENT INVESTIGATION
AEROMEXICO DC-10-30, XA-DUH, over Luxembourg, Europe
[NTSB-AAR-80-10] N81-12042
Aircraft accident report: New York Airways, Inc., Sikorsky S61-L, N618PA Newark, New Jersey, April 18, 1979
[NTSB-AAR-79-14] N81-12045
Aircraft accident report: Champion Home Builders company, Gates Learjet 25B, N999HG, Sanford, North Carolina, September 8, 1977
[NTSB-AAR-79-15] N81-12046
AIRCRAFT ACCIDENTS
Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mohawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044
Aircraft accident report: Champion Home Builders company, Gates Learjet 25B, N999HG, Sanford, North Carolina, September 8, 1977
[NTSB-AAR-79-15] N81-12046
Aircraft accident reports. Brief format, US civil aviation: Issue no. 11, 1979 accidents
[NTSB-BA-80-8] N81-12053
Status of improved autorotative landing capability research
[AD-A090431] N81-12072
AIRCRAFT COMPARTMENTS
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
AIRCRAFT CONSTRUCTION MATERIALS
Sonic fatigue design techniques for advanced composites aircraft structures
[AD-A090553] N81-12069
The changing scene of structural airworthiness
[AAAF-NT-79-24] N81-12076
Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078
The development of the composite material engine nacelle
[AAAF-NT-79-38] N81-12180
Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465
AIRCRAFT CONTROL
Propulsion controls N81-12095
Should we attempt global (inlet engine airframe) control design? N81-12097
Simulation comparison of a decoupled longitudinal control system and a velocity vector control wheel steering system during landings in wind shear
[NASA-TP-1734] N81-12109
Closed loop control systems: Aircraft. Citations from the NTIS data base
[PB80-813710] N81-12114
AIRCRAFT DESIGN
Aeronautical engineering. A continuing bibliography with indexes, supplement 127, October 1980
[NASA-SP-7037(127)] N81-12011
Low-speed aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications
[NASA-TP-1498] N81-12015
Should we attempt global (inlet engine airframe) control design? N81-12097
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Some new research approaches to aircraft spin studies
[AAAF-NT-80-12] N81-12112
Application of fracture mechanics to US Air Force aircraft structural integrity requirements
[AAAF-NT-79-25] N81-12463
AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935
NASA authorization, 1982 (program review), volume 1
[GPO-68-972] N81-12938
AIRCRAFT DETECTION
Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection --- detecting aircraft from satellites
[AD-A090644] N81-12146
AIRCRAFT ENGINES
Synopsis on aircraft integrated data systems and engine health monitoring and maintenance
[DFVLR-MITT-80-08] N81-12063
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
Propulsion Controls, 1979 --- air breathing engine control
[NASA-CP-2137] N81-12090
Should we attempt global (inlet engine airframe) control design? N81-12097
Road map to adaptive optimal control --- jet engine control N81-12098
Propulsion control and control theory: A new research focus N81-12099
Engine identification for adaptive control N81-12100
Multivariable synthesis with transfer functions --- applications to gas turbine engines N81-12102
Alternatives for jet engine control N81-12103
Metallurgical aspects of materials processing and manufacturing for aero-engine components --- gas turbine engines
[PNR-90019] N81-12209
Advanced industrial gas turbine techology readiness demonstration
[DOE/OR-05035/T1] N81-12426
AIRCRAFT FUELS
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652
AIRCRAFT GUIDANCE
LR-80 flight test report --- attitude and heading reference system
[AD-A090284] N81-12058
AIRCRAFT HAZARDS
AEROMEXICO DC-10-30, XA-DUH, over Luxembourg, Europe
[NTSB-AAR-80-10] N81-12042
AIRCRAFT LANDING
Aircraft towing feasibility study
[DOE/CS-50069/1] N81-12051
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068
Status of improved autorotative landing capability research
[AD-A090431] N81-12072
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
Simulation comparison of a decoupled longitudinal control system and a velocity vector control wheel steering system during landings in wind shear
[NASA-TP-1734] N81-12109
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536
AIRCRAFT MAINTENANCE
Naval aircraft operating and support cost-estimating model: FY78 revision
[AD-A090044] N81-12013
AIRCRAFT MANEUVERS
Flight test handbook: Flying qualities theory and flight test techniques
[AD-A090525] N81-12073

AIRCRAFT NOISE
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
Transonic rotor noise - theoretical and experimental comparisons
[AD-A090806] N81-12824
Spectral analysis of nonstationary random processes. Application to noise of flyover type
[ESA-TT-639] N81-12826
AIRCRAFT PERFORMANCE
Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
AIRCRAFT RELIABILITY
AEROMEXICO DC-10-30, XA-DUH, over Luxembourg, Europe
[NTSB-AAR-80-10] N81-12042
The changing scene of structural airworthiness
[AAAF-NT-79-24] N81-12076
Testing of composite structures
[AAAF-NT-79-41] N81-12181
AIRCRAFT SAFETY
Aviation safety
[GPO-68-717] N81-12040
Commuter airport safety
[GPO-60-512] N81-12041
AEROMEXICO DC-10-30, XA-DUH, over Luxembourg, Europe
[NTSB-AAR-80-10] N81-12042
Impact of modern materials on the development of rotating airfoil equipment
[AAAF-NT-79-43] N81-12182
Clear air turbulence. Citations from the NTIS data base
[PB80-814825] N81-12716
AIRCRAFT SPIN
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Some new research approaches to aircraft spin studies
[AAAF-NT-80-12] N81-12112
AIRCRAFT STABILITY
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113
AIRCRAFT STRUCTURES
The effect of thermal stresses on the integrity of three built-up aircraft structures
[NASA-TM-81352] N81-12064
The changing scene of structural airworthiness
[AAAF-NT-79-24] N81-12076
Mirage 2000 and Mirage 4000 fiber structures
[AAAF-NT-79-44] N81-12183
Aircraft surface coatings study: Energy efficient transport program --- sprayed and adhesive bonded coatings for drag reduction
[NASA-CR-158954] N81-12225
Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464
Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465
High-voltage spark carbon-fiber sticky-tape data analyzer
[NASA-CR-163747] N81-12646
AIRCRAFT WAKES
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
B-52 wake investigation
[LOG-C3932] N81-12020
AIRFOIL PROFILES
Synthesis of test results obtained with Concorde at high incidences
[AAAF-NT-80-26] N81-12079
Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2
[NASA-CR-159879] N81-12087
AIRFOILS
A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018
Experiments on an airfoil at high incidence in plunging motion
[AAAF-NT-80-09] N81-12030
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
AIRFRAME MATERIALS
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081
Testing of composite structures
[AAAF-NT-79-41] N81-12181
Manual for the AGARD-coordinated Corrosion Fatigue Cooperative Testing Program (CFCTP)
[NLR-MP-79017-U] N81-12474
AIRLINE OPERATIONS
Aviation safety
[GPO-68-717] N81-12040
Commuter airport safety
[GPO-60-512] N81-12041
AIRPORTS
Commuter airport safety
[GPO-60-512] N81-12041
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
ALABAMA
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
ALBEDO
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
ALCOHOLS
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
ALGEBRA
A natural data type with a finite equational final semantics specification but no effective equational initial semantics specification
[MC-IW-133/80] N81-12799
An algorithm module for abstract algebra
N81-12803
ALGORITHMS
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
SLBM fire control computational algorithms in support of stellar inertial guidance
[AD-A090650] N81-12057
Performance seeking controls N81-12092
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
Contextual classification of multispectral image data: Approximate algorithm
[E81-10038] N81-12520
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
Some aspects on improvements of a first-order dynamic optimization algorithm
[SAAB-TN-AE-73] N81-12769
Algorithmic solution of some queues with overflows
[AD-A090771] N81-12779
Efficient multipliers for the FFT
[AD-A090648] N81-12789
Convergence of iterative nonexpansive signal reconstruction algorithms
[NASA-CR-163799] N81-12790
The multiple stack algorithm implemented on a Zilog Z-80 microcomputer
[AD-A090606] N81-12791
An algorithm module for abstract algebra
N81-12803
ALIPHATIC COMPOUNDS
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200
Polyketones and polysulfones for conservation in the ethylene polymer
[BNL-51155] N81-12237
ALLOYS
Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216
ALTERNATING CURRENT
Non-contacting power transfer device
[NASA-CASE-GSC-12595-1] N81-12331
Solar cell system having alternating current output
[NASA-CASE-LEW-12806-2] N81-12542
ALTERNATIVES
Alternative transportation fuels
[CONF-800419-5] N81-12267
ALTITUDE TESTS
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
ALUMINUM
Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
Ultrasonic seam welding
[BDX-613-2444] N81-12431
Inert gas welding. Citations from the Engineering Index data base
[PB80-815228] N81-12436
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920
ALUMINUM ALLOYS
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212
Effect of various surface protections on the stress corrosion behavior of light alloys --- aluminum alloys
[SNIAS-801-551-102] N81-12220
Influence of thermomechanical treatment on microstructure and mechanical properties of high-strength aluminum alloys
[ESA-TT-507] N81-12222
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440
Experimental methodology. Application of concepts from mechanics to material rupture studies
[SNIAS-801-551-104] N81-12466
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615
ALUMINUM COMPOUNDS
Large high quality single crystal aluminum phosphate for acoustic wave devices
[AD-A090359] N81-12905
Passivation of GaAs surfaces
[AD-A090512] N81-12909
ALUMINUM GALLIUM ARSENIDES
Room temperature, CW, single mode laser
[AD-A090326] N81-12410
Night vision devices. Citations from the NTIS data base
[PB80-814957] N81-12879
Passivation of GaAs surfaces
[AD-A090512] N81-12909
ALUMINUM OXIDES
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870
AMBIENT TEMPERATURE
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
[AERONOMICA-ACTA-A-206-1979] N81-12670
The structure of air temperature fluctuations in the northern hemisphere, part 2.
[BLL-TRANS-1434-(9022.549)-PT-2] N81-12695

AMERICAN INDIANS
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519
AMMONIA
Passivation of GaAs surfaces
[AD-A090512] N81-12909
AMPLIFIERS
Three dimensional non-linear theory of the free electron laser
[AD-A090321] N81-12409
AMPLITUDE DISTRIBUTION ANALYSIS
The 1976 earthquake sequence in Uzbekistan: Focal mechanisms determined using the relative amplitude method
[AWRE-O-27/80] N81-12692
ANALOG TO DIGITAL CONVERTERS
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
ANALYSIS (MATHEMATICS)
Wave power extraction from a transient heaving cylinder
[DOE/ET-21019/T1] N81-12599
ANGLE OF ATTACK
Low-speed aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications
[NASA-TP-1498] N81-12015
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448
ANGULAR MOMENTUM
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142
ANGULAR VELOCITY
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386
Spinning plasma ring stable to tilting mode
[IPPJ-478] N81-12884
ANIMALS
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660
ANNEALING
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910
ANNUAL VARIATIONS
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
ANNULAR SUSPENSION AND POINTING SYSTEM
Design of the Annular Suspension and Pointing System (ASPS) (including design addendum)
[NASA-CR-3343] N81-12158
ANODES
A preliminary investigation of the behavior of titanium-lead dioxide electrodes
[ECRC/M1266] N81-12349
ANTENNA ARRAYS
Overlapped subarraying techniques
[AD-A089693] N81-12304
ANTENNA DESIGN
A technology development program for large space antennas
[NASA-TM-81902] N81-12155
Research in progress: Antennas, Propagation and Digital Image Processing Group (APDIP) N81-12317
ANTENNA RADIATION PATTERNS
Multi-mode horn antenna simulation
[NASA-TM-80705] N81-12298
Overlapped subarraying techniques
[AD-A089693] N81-12304
An analysis of the various methods used to analyze radiation from the thin wire E field integral equation
[AD-A090488] N81-12307
Research in progress: Antennas, Propagation and Digital Image Processing Group (APDIP) N81-12317
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537
ANTHROPOMETRY
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Space shuttle and Galileo mission
[GPO-53-938] N81-12940
APPROXIMATION
Stochastic approximation with discontinuous dynamics and state dependent noise w.p.1 convergence
[AD-A089777] N81-12805
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872
ARCTIC OCEAN
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687
ARCTIC REGIONS
Planetary-wave behavior and arctic air pollution
[DOE/EV-01340/T2] N81-12657
ARGON
Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188
ARGON PLASMA
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
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ARIANE LAUNCH VEHICLE
IRIS derived rocket (IDR) to be used as Ariane 4th stage
[ESA-CR(P)-1370] N81-12166
ARIZONA
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519
ARMED FORCES (UNITED STATES)
Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096
ARRAYS
Development of a fold-out rigid solar array for three axis-stabilized geosynchronous satellites
[SNIAS-801-440-101] N81-12150
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326
C-MOS array design techniques
[NASA-CR-150799] N81-12328
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389
ARTIFICIAL INTELLIGENCE
A study of knowledge-based systems for photo interpretation
[AD-A090465] N81-12530
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777
ARTIFICIAL SATELLITES
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143
ASPECT RATIO
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083
ASSEMBLY LANGUAGE
Programming language design. Citations from the NTIS data base
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ASSESSMENTS
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[AD-A090529] N81-12650
ASSOCIATIVE PROCESSING (COMPUTERS)
Holographic associative memories in document retrieval systems
[BMFT-FB-DV-79-05] N81-12931
ASTEROIDS
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143
ASTRONAVIGATION
Astroinertial navigation for cruise applications
[AD-A090649] N81-12059
ASTRONOMICAL PHOTOGRAPHY
Selenocentric control system (1979)
[AD-A090543] N81-12969
ASTROPHYSICS
Future prospects for gamma-ray
[NASA-TM-82041] N81-12959
ASYMMETRY
Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685
Clines in the presence of asymmetric migration
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ASYMPTOTIC METHODS
On a general asymptotic independence: Result in statistics, a preliminary report
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Asymptotic behavior for a strongly damped nonlinear wave equation
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ATMOSPHERIC CIRCULATION
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
The structure of air temperature fluctuations in the northern hemisphere, part 2.
[BLL-TRANS-1434-(9022.549)-PT-2] N81-12695
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program N81-12708
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ATMOSPHERIC COMPOSITION
Carbon dioxide effects research and assessment program. A comprehensive plan. Part 1: The global carbon cycle and climatic effects of increasing carbon dioxide
[DOE/EV-0094] N81-12201
The aeronomy of vibrationally excited ozone
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ATMOSPHERIC DENSITY
Interlevel correlations of temperature and density, surface to 60 km
[AD-A090515] N81-12130
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ATMOSPHERIC EFFECTS
Correlation and prediction of propagation time-delays along earth-space links
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Atmospheric effects on laser beams. Citations from the NTIS data base
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An assessment of the atmospheric effects of a satellite power system
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ATMOSPHERIC ENTRY
Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body
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ATMOSPHERIC HEAT BUDGET
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
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ATMOSPHERIC MODELS
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ATMOSPHERIC OPTICS
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ATMOSPHERIC RADIATION
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[ONERA-NT-1980-3] N81-12878

ATMOSPHERIC REFRACTION
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306

ATMOSPHERIC SOUNDING
A description of the NSSL cases used for a simulated VAS retrieval study
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ATMOSPHERIC STRATIFICATION
Stratospheric layering photographed --- from a balloon gondola
[AERONOMICA-ACTA-C-54-1979] N81-12674

ATMOSPHERIC TEMPERATURE
Interlevel correlations of temperature and density, surface to 60 km
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The structure of air temperature fluctuations in the northern hemisphere, part 2.
[BLL-TRANS-1434-(9022.549)-PT-2] N81-12695

ATMOSPHERIC TURBULENCE
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[KNMI-WR-80-3] N81-12706

ATOMIC COLLISIONS
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831
Theoretical studies relating to the interaction of radiation with matter: Atomic collision processes occurring in the presence of radiation fields
[AD-A090528] N81-12832
Two-particle correlations in nuclear collisions
[LBL-11320] N81-12859

ATOMIC EXCITATIONS
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Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference
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ATOMIC PHYSICS
Photoemission from solids: The transition from solid-state to atomic physics
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ATOMIC THEORY
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[AD-A090336] N81-12829

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Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
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Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138

ATTACK AIRCRAFT
Army GPS-doppler hybrid navigation system
[AD-A090394] N81-12062

ATTITUDE CONTROL
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074

ATTITUDE INDICATORS
LR-80 flight test report --- attitude and heading reference system
[AD-A090284] N81-12058

ATTITUDE STABILITY
Method of and apparatus for damping nutation motion with minimum spin axis attitude disturbance
[NASA-CASE-GSC-12551-1] N81-12156

AUDIO FREQUENCIES
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech
[RAE-TM-FS-334] N81-12737

AUDITORY PERCEPTION
Effects of low power microwaves on the local cerebral blood flow of conscious rats
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AUSTRALIA
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068

AUTOCORRELATION
A computer based ionospheric sounding and HF noise measuring system
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AUTOMATIC FLIGHT CONTROL
A mathematical model of the CH-53 helicopter
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AUTOMATIC PILOTS
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067
New techniques for test development for tactical auto-pilots using microprocessors
[AD-A090641] N81-12149

AUTOMOBILE ENGINES
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270

AUTOMOBILES
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
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[DOE-TR-229] N81-12951
The Federal electric and hybrid vehicle program N81-12986
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987

AUTOROTATION
Status of improved autorotative landing capability research
[AD-A090431] N81-12072

AVIONICS
Ring laser gyro
[AD-A090643] N81-12395

AXIAL COMPRESSION LOADS
Axial compression testing of vacuum tube glass ceramic/molybdenum frames
[GEPP-TIS-503] N81-12238

AXIAL FLOW TURBINES
Stability of large horizontal-axis axisymmetric wind turbines
[NASA-TM-81623] N81-12446

AXISYMMETRIC FLOW
Stability of large horizontal-axis axisymmetric wind turbines
[NASA-TM-81623] N81-12446

B

B-52 AIRCRAFT
B-52 wake investigation
[LOG-C3932] N81-12020

BACKSCATTERING
A computer based ionospheric sounding and HF noise measuring system
[ERL-0146-TR] N81-12299
Fundamental limitations of electron beam lithography for future military IC fabrication
[AD-A090407] N81-12336
The CISE tandem vandeGraaf accelerator and its fields of use
[CISE-N-191] N81-12820

BACKWARD WAVES
Large signal TWT computer theory
[AD-A090748] N81-12340

BACTERIA
Mechanisms of recombination and function of DNA in bacteria
[DOE/EV-03941/52] N81-12721

BALANCE
DYMAC digital electronic balance
[LA-8313-M] N81-12398

BALLISTICS
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds
[AD-A090443] N81-12027
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425

BAND STRUCTURE OF SOLIDS
Photoemission from solids: The transition from solid-state to atomic physics
[LBL-11276] N81-12871

BANDWIDTH
A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314

BARLEY
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535

BAROCLINIC INSTABILITY
Theoretical regime diagrams for thermally driven flows in a beta-plane channel in the presence of variable gravity
[NASA-TM-78316] N81-12676

BARYONS
Bag model, the hyperspherical formalism and the heavy baryons
[BNL-28198] N81-12836

BAYES THEOREM
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
Nonparametric tests of independence for censored data
[AD-A090330] N81-12808

BAYS (TOPOGRAPHIC FEATURES)
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501

BEAM PLASMA AMPLIFIERS
Beam-beam interactions for bunched and unbunched beams
[BNL-28186] N81-12852

BEAM WAVEGUIDES
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387

BEAMS (RADIATION)
Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407
Spatial coherence and intensity properties of quasihomogeneous optical sources
[AD-A090378] N81-12413
Beam-beam interactions for bunched and unbunched beams
[BNL-28186] N81-12852
BEAMS (SUPPORTS)
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283
Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468
BEDROCK
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
BESSEL FUNCTIONS
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303
CDC 6600/7600 subroutine for bessel functions Y/sub nx x 0, nu or = 0
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A note on two integrals related with Bessel functions
[MC-TW-199/80] N81-12800
BETA FACTOR
Absorption of magnetoacoustic waves in a high beta plasma
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BETA PARTICLES
Two dimensional behavior of solitons in a low-b plasma with convective motion
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Anthropometry: Basic studies and applications. Citations from the NTIS data base
[PB80-813645] N81-12736
Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813405] N81-12755
Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813413] N81-12756
Read only memories. Citations from the NTIS data base
[PB80-814833] N81-12757
Computer storage management. Citations from NTIS data base
[PB80-814759] N81-12758
Programming language design. Citations from the NTIS data base
[PB80-814767] N81-12773
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814239] N81-12784
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814221] N81-12785
Night vision devices. Citations from the NTIS data base
[PB80-814957] N81-12879
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880
On-line information retrieval systems. Citations from the NTIS data base
[PB80-814841] N81-12934
AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935
Mars environment. Citations from the NTIS data base
[PB80-814999] N81-12970
BINARY ALLOYS
A15 multifilamentary superconductors by the infiltration process
[LBL-10761] N81-12342
BIOCHEMICAL FUEL CELLS
Fuel cells. Citations from the NTIS data base
[PB80-813397] N81-12640
BIOCONVERSION
Agricultural waste products as alternative energy sources
[GPO-62-991] N81-12561
BIODYNAMICS
Parameter identification techniques for physiological control systems
[AD-A090547] N81-12728
On parachutist dynamics
[AD-A090335] N81-12741
BIOENGINEERING
Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725
BIOLOGICAL EFFECTS
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 211, October 1980
[NASA-SP-7011(211)] N81-12723
Laboratory investigations of biomedical factors influencing laser designator operator performance
[AD-A090425] N81-12739
BIOLOGICAL EVOLUTION
Clines in the presence of asymmetric migration
[MC-TW-200/80] N81-12811
BIOMASS
Grain ethanol as a petroleum substitute: A perspective
[ANL/SPG-9] N81-12279
Effects of management practices on reflectance of spring wheat canopies — Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Sorghums as energy crops
[CONF-800482-5] N81-12534
BIOMASS ENERGY PRODUCTION
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
Sorghums as energy crops
[CONF-800482-5] N81-12534
Agricultural waste products as alternative energy sources
[GPO-62-991] N81-12561
Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
BIOPHYSICS
Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725
BIRDS
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
BIREFRINGENT COATINGS
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic liquid crystals
[NASA-TM-81628] N81-12817
BIVARIATE ANALYSIS
Nonparametric tests of independence for censored data
[AD-A090330] N81-12808
BLADE TIPS
Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2
[NASA-CR-159879] N81-12087
BLIGHT
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
BLOWERS
System to measure the pressure distribution on fan aerofoil surfaces during flutter conditions
[PNR-90013] N81-12029

BOATTAILS
Three component measurements on a body with various afterbody configurations in subsonic and transonic flow
[ESA-TT-628] N81-12151
BODIES OF REVOLUTION
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123
BOILERS
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
BOLLWORMS
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707
BOOLEAN ALGEBRA
Development of Boolean calculus and its applications --- digital systems design
[NASA-CR-163802] N81-12786
BOOLEAN FUNCTIONS
Quadric solids and computational geometry
[BDX-613-2484] N81-12794
BORIDES
Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924
BOSON FIELDS
Looking for heavier weak bosons with DUMAND
[NASA-TM-82027] N81-12828
BOUNDARY LAYER CONTROL
Core compressor exit stage study. Volume 3: Data and performance report for screening test configurations
[NASA-CR-159499] N81-12086
Effects of boundary-layer treatment on cryogenic wind-tunnel controls
[NASA-CR-159372] N81-12120
BOUNDARY LAYER FLOW
Modeling and control of transonic cryogenic wind tunnel: A summary report
[NASA-CR-159376] N81-12121
BOUNDARY LAYER TRANSITION
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
Experimental analysis of the boundary layer transition with zero and positive pressure gradient
[NASA-TM-75763] N81-12359
BOUNDARY LAYERS
Measurements in a two dimensional wake merging into a boundary layer
[NLR-TR-79063-U] N81-12034
Sheared zone considerations in incompressible turbulent boundary layer calculations
[AAAF-NT-80-03] N81-12355
Characterization of internal boundary layer capacitors
[DOE/ER-01198/1311] N81-12916
BOW WAVES
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
BRAIN CIRCULATION
Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720
BRAZIL
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500
BREADBOARD MODELS
AVHRR/1-FM Advanced Very High Resolution Radiometer
[NASA-CR-160059] N81-12392
BREMSSTRAHLUNG
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922
BRIGHTNESS
Search for faint galactic features --- digital image processing
[LA-UR-80-2357] N81-12960
BRILLOUIN ZONES
Brillouin scattering studies of the effect of orientation on the mechanically deformed poly-(ethylene terepthalate)
[AD-A090589] N81-12866
BRONZES
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212
BUBBLE MEMORY DEVICES
Investigation of multilayer magnetic domain lattice file
[NASA-CR-159324] N81-12745
BUBBLES
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
BUCKLING
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
BUMPY TORUSES
Bumpy torus transport in the low collision frequency limit
[SAI-254-80-347-LJ] N81-12894
BUNCHING
Beam-beam interactions for bunched and unbunched beams
[BNL-28186] N81-12852
BURNING RATE
Burning rate transitions for HMX burned as a binderless propellant
[AD-A090389] N81-12258
BURSTS
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427
On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973
BUTADIENE
Properties of some diblock copolymers based on 1,3 butadiene monomer
[AD-A090144] N81-12230

C

CADMIUM COMPOUNDS
Epitaxial growth of CdSnP2 on InP for microwave FETs
[AD-A090285] N81-12913
CADMIUM SULFIDES
Indium phosphide/cadmium sulfide thin-film solar cells
[SERI/PR-8170-1-T1] N81-12616
CADMIUM TELLURIDES
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
CALCULUS
Development of Boolean calculus and its applications --- digital systems design
[NASA-CR-163802] N81-12786
CALIBRATING
Magsat vector magnetometer calibration using Magsat geomagnetic field measurements
[NASA-TM-82046] N81-12527
CALORIMETERS
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168
CAMBER
Assessment of variable camber for application to transport aircraft
[NASA-CR-158430] N81-12016
CANADA
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
CANOPIES (VEGETATION)
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
CANTILEVER BEAMS
The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470
CAPACITORS
A new method of roundness measurement by capacitative detectors
[ESA-TT-635] N81-12292
Characterization of internal boundary layer capacitors
[DOE/ER-01198/1311] N81-12916
CARBIDES
System design of advanced carbide fuel
[COO-2426-205] N81-12265
CARBON
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154
CARBON CYCLE
Carbon dioxide effects research and assessment program. A comprehensive plan. Part 1: The global carbon cycle and climatic effects of increasing carbon dioxide
[DOE/EV-0094] N81-12201
CARBON DIOXIDE
Carbon dioxide effects research and assessment program. A comprehensive plan. Part 1: The global carbon cycle and climatic effects of increasing carbon dioxide
[DOE/EV-0094] N81-12201
Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533
CARBON DIOXIDE LASERS
Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411
Pulse code modulation of CO2 tea laser pulse
[AD-A090436] N81-12412
Laser cutting plastic materials
[BDX-613-2476] N81-12417
Effects of xenon cover gas in CO2 laser welding
[BDX-613-2442] N81-12430
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 1
[NASA-CR-161611] N81-12697
CARBON FIBER REINFORCED PLASTICS
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077
Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078
The development of the composite material engine nacelle
[AAAF-NT-79-38] N81-12180
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
Acoustic emission of carbon fiber reinforced plastics
[FOK-R-2464] N81-12250
Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464

CARBON FIBERS
Laser interaction with TBR materials
[AD-A090429] N81-12177
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
High-voltage spark carbon-fiber sticky-tape data analyzer
[NASA-CR-163747] N81-12646
CARBONATES
Effects of several trace contaminants on fuel cell performance
[DOE/METC-RI-80-17] N81-12591
CARBOXYLIC ACIDS
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911
CARGO SPACECRAFT
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
CARRIER MOBILITY
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
CARRIER TRANSPORT (SOLID STATE)
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236
CASCADE WIND TUNNELS
Heat transfer measurements related to hot turbine components in the von Karman Institute hot cascade tunnel N81-12999
Heat transfer rate and film cooling effectiveness measurements in a transient cascade N81-13000
CAST ALLOYS
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170
CASTING
Metallurgical aspects of materials processing and manufacturing for aero-engine components --- gas turbine engines
[PNR-90019] N81-12209
CASTINGS
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
CATALYSTS
Development of alcohol-based synthetic transportation fuels from coal-derived synthesis gases
[DOE/ET-14858/2] N81-12266
CATHODOLUMINESCENCE
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914
CAVITIES
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454
Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455
CAVITY RESONATORS
Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407
CELESTIAL NAVIGATION
SLBM fire control computational algorithms in support of stellar inertial guidance
[AD-A090650] N81-12057
CELLULOSE
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
CEMENTS
Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203
CENSUS
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
CENTRAL PROCESSING UNITS
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
Design, development, fabrication and delivery of register and multiplexer units --- CMOS monolithic chip development
[NASA-CR-150801] N81-12746
CENTRIFUGAL PUMPS
Principle of laser Doppler velocimeter measurements in a fully transparent pump
[VKI-PREPRINT-1979-12] N81-12375
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433
CENTRIFUGES
A check panel for the MSE analytical ultracentrifuge N81-12404
CERAMICS
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232
Crack propagation and deformation in PZT transducer ceramics
[AD-A090569] N81-12234
Development of nondestructive evaluation techniques for high-temperature ceramic heat exchanger components
[ANL/MSD/FE-80-4] N81-12617
Production technology of beta-alumina ceramics for Na/S batteries
[BMFT-FB-T-79-57] N81-12629
Characterization of internal boundary layer capacitors
[DOE/ER-01198/1311] N81-12916
CERENKOV RADIATION
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
CESIUM ENGINES
Field emission electric propulsion. Development and manufacturing of a positive pressure tank
[ESA-CR(P)-1365] N81-12165
CHANNEL FLOW
Numerical analysis of the flow in the connecting passage between the fan section and high pressure section of a turbojet engine
[AD-A090506] N81-12107
CHANNELS (DATA TRANSMISSION)
Wideband multiplex system
[AD-A090770] N81-12312
POSER: A Process Organization to Simplify Error Recovery --- fault tolerant real time computer systems
[RSRE-MEMO-3249] N81-12772
CHARACTERIZATION
A characterization of Gorenstein orders in quaternion algebras
[CTH-MATH-1980-6] N81-12816
CHARGE COUPLED DEVICES
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
CHARGE DISTRIBUTION
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168
CHARGE EFFICIENCY
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987
CHARGE TRANSFER
Spacecraft charging on ATS-5
[AD-A090508] N81-12147
CHECKOUT
A check panel for the MSE analytical ultracentrifuge N81-12404
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
CHEMICAL ANALYSIS
Trace chemical analysis methodology
[AD-A090762] N81-12191
Sampling and analysis of hydrocarbons in combustion gases
[ANL/CEN/FE-80-11] N81-12204
X-ray fluorescence analysis of metal concentration in an alloy electroplating bath
[BDX-613-2411] N81-12205
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615
CHEMICAL BONDS
Passivation of GaAs surfaces
[AD-A090512] N81-12909
CHEMICAL COMPOSITION
Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268
Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993
CHEMICAL LASERS
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365
CHEMICAL REACTIONS
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263
CHEMICAL REACTORS
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
CHEMISTRY
Software standards in chemistry
[LBL-9881] N81-12169
CHIMNEYS
Tracking of smokestack and cooling tower plumes using wind measurements at different levels
[ORNL/TM-7417] N81-12654
CHINESE PEOPLES REPUBLIC
Technology transfer to China
[GPO-58-034] N81-12947
Technology transfer to China
[GPO-62-976] N81-12948
CHIPS (ELECTRONICS)
Design, development, fabrication and delivery of register and multiplexer units --- CMOS monolithic chip development
[NASA-CR-150801] N81-12746
CHIPS (MEMORY DEVICES)
User's manual for large-scale integrated circuit layout check program
[NASA-TM-78192] N81-12325
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
CHROMIUM
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
Thin film corrosion
[BDX-613-2435] N81-12217
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
CHROMIUM ALLOYS
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
CHROMOSOMES
Mechanisms of recombination and function of DNA in bacteria
[DOE/EV-03941/52] N81-12721
CIRCADIAN RHYTHMS
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727
CIRCUIT BOARDS
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
CIRCUIT DIAGRAMS
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054
User's manual for large-scale integrated circuit layout check program
[NASA-TM-78192] N81-12325
C-MOS array design techniques
[NASA-CR-150799] N81-12328
The PR2D (Place, Route in 2-Dimensions) automatic layout computer program handbook
[NASA-RP-1029] N81-12760
CIRCUIT RELIABILITY
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347

The large scale microelectronics Computer-Aided Design and Test (CADAT) system
[NASA-TM-78202] N81-12747

CIRCUITS

Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
Investigation of multilayer magnetic domain lattice file
[NASA-CR-159324] N81-12745

CIRCULATION CONTROL AIRFOILS

Low drag airfoil design utilizing passive laminar flow and coupled diffusion control techniques
[AD-A090778] N81-12024

CIRCUMSOLAR RADIATION

Observation of the solar ultraviolet radiation
[AERONOMICA-ACTA-A-211-1980] N81-12972

CITIES

Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952

CIVIL AVIATION

Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
Aviation safety
[GPO-68-717] N81-12040
Commuter air carrier loan guarantee study
[AD-A090615] N81-12047
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
NASA Research in aeropropulsion N81-12980

CLASSIFICATIONS

Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
Contextual classification of multispectral image data: Approximate algorithm
[E81-10038] N81-12520

CLEANING

Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188

CLEAR AIR TURBULENCE

Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 1
[NASA-CR-161611] N81-12697
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
Clear air turbulence. Citations from the NTIS data base
[PB80-814825] N81-12716

CLIMATE

Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696

CLIMATOLOGY

Carbon dioxide effects research and assessment program. A comprehensive plan. Part 1: The global carbon cycle and climatic effects of increasing carbon dioxide
[DOE/EV-0094] N81-12201
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
The structure of air temperature fluctuations in the northern hemisphere, part 2.
[BLL-TRANS-1434-(9022.549)-PT-2] N81-12695
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program N81-12708
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715

CLOUD COVER

Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715

CLOUDS

Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883

CMOS

High speed CMOS/SOS standard cell notebook
[NASA-CR-150783] N81-12323
C-MOS array design techniques
[NASA-CR-150799] N81-12328

COAL

Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203
Studies of the mechanisms of coal hydrogenation by electron spin resonance
[DOE/PC-30072/T1] N81-12272
Overall requirements for an advanced underground coal extraction system --- environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523
Coal thickness guage using RRAS techniques, parts 2 and 3
[NASA-CR-161607] N81-12524
International energy indicators --- coal, crude oil, nuclear generation capacity petroleum products
[DOE/IA-0010/2] N81-12588

COAL GASIFICATION

Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216
Alternative process schemes for coal conversion
[BNL-51233] N81-12278
Effects of several trace contaminants on fuel cell performance
[DOE/METC-RI-80-17] N81-12591
Coal gasifier cogeneration powerplant project N81-12988

COAL LIQUEFACTION

Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
Pressure vessels for coal liquefaction: An overview
[IS-M-282] N81-12429
Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567

COAL UTILIZATION

Correlation of the high-temperature corrosion behavior of structural alloys in coal conversion environments with the components of the alloys and of the corrosive environments
[BMI-2059] N81-12213
Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4
[DOE/RG-10075/T1] N81-12269
Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
Support studies in fluidized-bed combustion
[ANL/CEN/FE-79-14] N81-12280
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649
In pursuit of clean air: A data book of problems and strategies at the state level. Volume 3: Federal regions 4 and 6
[ANL/EES-TM-90-VOL-3] N81-12656
Coal gasifier cogeneration powerplant project N81-12988

COASTAL ECOLOGY

Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486

COASTAL PLAINS

Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501

COATINGS

Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233

COBALT ALLOYS

Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818

CODING

Coding and processing for reliable data transmission
[AD-A090406] N81-12315
The compilation of regular expressions into integrated circuits
[AD-A090507] N81-12334
Technical regulations: Hydrology and international hydrological codes
[WMO-555] N81-12540

COEFFICIENT OF FRICTION

Determination of coefficients for the universal laws of friction and heat transfer for CFTL calculations --- reactor core flow
[ORNL/TM-7418] N81-12819

COGENERATION

Coal gasifier cogeneration powerplant project N81-12988

COHERENT ELECTROMAGNETIC RADIATION

Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407

COHERENT LIGHT

Laser satellite power systems
[ANL/ES-92] N81-12592

COHERENT RADIATION

Spatial coherence and intensity properties of quasihomogeneous optical sources
[AD-A090378] N81-12413
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922

COLD PLASMAS

Effect of a dc electric field on the trapping dynamics of a cold electron beam
[AD-A090810] N81-12888

COLLIMATORS

Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387
AVHRR/1-FM Advanced Very High Resolution Radiometer
[NASA-CR-160059] N81-12392

COLLISION PARAMETERS

Trapped electron modifications to tearing modes in the low collision frequency limit
[SAI-245-80-348-LJ] N81-12846
Collisional end losses from conventional and tandem mirrors
[SAI-254-80-442-LJ] N81-12892
Bumpy torus transport in the low collision frequency limit
[SAI-254-80-347-LJ] N81-12894

COLLISIONLESS PLASMAS

A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
Maxwell-Vlasov equations as a continuous Hamiltonian system
[PPPL-1702] N81-12797
Wave propagation in a temperate plasma having n ions species
[IPF-78-7] N81-12899

COLLOIDS

Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271

COLOR TELEVISION

A special-purpose processor for an automatic feature extraction system
[AD-A090789] N81-12765

COLOR VISION

Peripheral cues and color in visual simulation
[AD-A089837] N81-12726

COLORADO
Multistage variable probability forest volume inventory — Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519
COLUMNS (SUPPORTS)
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283
COMBAT
Frequency diverse tracking/guidance millimeter radar adapted to target acquisition
[AD-A090355] N81-12305
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424
COMBINED STRESS
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454
COMBUSTION
Fast deflagration waves
[AD-A090776] N81-12190
Three dimensional finite element combustion instability analysis
[AD-A090396] N81-12194
Support studies in fluidized-bed combustion
[ANL/CEN/FE-79-14] N81-12280
Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993
COMBUSTION CHAMBERS
Effect of ambient conditions on the emissions from a gas turbine combustor
[NASA-CR-3355] N81-12105
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994
Technical suppositions developed for smoke measurements during high pressure full annular combustor tests and engine trials N81-12995
Velocity and temperature measurements in a premixed flame within an axisymmetric combustor N81-13006
COMBUSTION PHYSICS
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
The study of turbulent diffusion flames: Modeling needs and experimental light scattering capabilities N81-13011
Applications of optical diagnostic techniques in combustion research N81-13013
Droplet size measurements in combustion by the visibility method N81-13014
COMBUSTION PRODUCTS
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
Production of nitrous oxide in a rocket motor exhaust
[PERME-MEMO-96] N81-12167
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197
Sampling and analysis of hydrocarbons in combustion gases
[ANL/CEN/FE-80-11] N81-12204
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
Diagnosing combustion by D.R.A.S.C. — coherent anti-Stokes Raman spectroscopy N81-13009
COMMAND AND CONTROL
Computer aided control system design. A conversion report
[CRI-110] N81-12752
COMMERCIAL AIRCRAFT
Commuter airport safety
[GPO-60-512] N81-12041
NASA Research in aeropropulsion N81-12980
COMMERCIAL ENERGY
Heat recovery devices, new
[PB80-205438] N81-12384
Energy use in office buildings. Volume 1: Analysis of 1977 office building energy use as reported in the Building Owners and Managers Association Data Base
[DOE/CS-20189/1] N81-12593
COMMUNICATION NETWORKS
A uniform representation of single and multi-stage interconnection networks used in SIMD machines
[AD-A089688] N81-12300
Optimal resource placement in a distributed system (extended abstract)
[AD-A090772] N81-12780
COMMUNICATION SATELLITES
Next generation communications satellites: Multiple access and network studies
[NASA-CR-165145] N81-12139
COMMUNICATIONS TECHNOLOGY SATELLITE
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967 - 1980 reference book, volume 1
[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138
COMPARISON
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
COMPATIBILITY
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
COMPILERS
The GMC system for central memory management
[ONERA-NT-1979-12] N81-12751
Honeywell information systems, COBOLA 2.0, level 6, MOD 0400 COBOL compiler
[PB80-204969] N81-12759
Programming language design. Citations from the NTIS data base
[PB80-814767] N81-12773
COMPONENT RELIABILITY
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880
Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953
COMPOSITE MATERIALS
Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081
Laser interaction with TBR materials
[AD-A090429] N81-12177
Simultaneous measurement of multilayered composites
[BDX-613-2407] N81-12178
Testing of composite structures
[AAAF-NT-79-41] N81-12181
Impact of modern materials on the development of rotating airfoil equipment
[AAAF-NT-79-43] N81-12182
Mirage 2000 and Mirage 4000 fiber structures
[AAAF-NT-79-44] N81-12183
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184
Investigation of impact damage in sandwich panels with face sheets of composite materials
[NLR-TR-79011-U] N81-12187
Test methods for the dynamic mechanical properties of polymeric materials
[BDX-613-2405] N81-12246
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403
High-voltage spark carbon-fiber sticky-tape data analyzer
[NASA-CR-163747] N81-12646
Progress in materials and structures at Lewis Research Center N81-12962
COMPOSITE STRUCTURES
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077
Contact law and impact responses of laminated composites
[NASA-CR-159884] N81-12172
Evaluation of filament-wound Kevlar-49/epoxy fatigue properties
[UCRL-15264] N81-12224
Proceedings of the Army symposium on solid mechanics. Designing for extremes: Environment, Loading, and Structural Behavior
[AD-A090684] N81-12285
COMPOSITION (PROPERTY)
Morphology and phase composition of an amine cured rubber modified epoxy
[SAND-80-1914C] N81-12242
COMPOUNDS
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
COMPRESSION TESTS
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
Axial compression testing of vacuum tube glass ceramic/molybdenum frames
[GEPP-TIS-503] N81-12238
Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465
COMPRESSOR BLADES
Core compressor exit stage study. Volume 3: Data and performance report for screening test configurations
[NASA-CR-159499] N81-12086
The effects of solidity, interblade phase angle and reduced frequency on the time-variant aerodynamic response of a compressor stator
[AD-A090546] N81-12108
COMPRESSOR ROTORS
Core compressor exit stage study. Volume 3: Data and performance report for screening test configurations
[NASA-CR-159499] N81-12086
Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2
[NASA-CR-159879] N81-12087
COMPRESSORS
The effects of solidity, interblade phase angle and reduced frequency on the time-variant aerodynamic response of a compressor stator
[AD-A090546] N81-12108
COMPUTATION
A phenomenological method of calculating microwave longitudinal coupling impedances
[BNL-51222] N81-12316
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731
CDC 6600/7600 subroutine for bessel functions Y/sub nx x 0, nu or = 0
[SAND-80-1498] N81-12796
COMPUTATIONAL FLUID DYNAMICS
A computer program to calculate the longitudinal aerodynamic characteristics of upper-surface-blown wing-flap configurations
[NASA-CR-3005] N81-12014
A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018

Evaluation of Levinsky's method for the calculation of the lift distribution on a wing in propulsive jets
[NLR-TR-77104-U] N81-12033
Lagrangian three-dimensional finite-element formulation for the nonlinear fluid-structural response of reactor components
[ANL-80-26] N81-12461

COMPUTER DESIGN
A special-purpose processor for an automatic feature extraction system
[AD-A090789] N81-12765

COMPUTER GRAPHICS
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
Guidelines in preparing computer-generated plots for NASA technical reports with the LRC graphics output system
[NASA-TM-81908] N81-12761

COMPUTER NETWORKS
On developing a theory of distributed computing summary of current research
[AD-A090773] N81-12750
On-line information retrieval systems. Citations from the NTIS data base
[PB80-814841] N81-12934

COMPUTER PROGRAM INTEGRITY
Software standards in chemistry
[LBL-9881] N81-12169
Honeywell information systems, COBOLA 2.0, level 6, MOD 0400 COBOL compiler
[PB80-204969] N81-12759
Graph theory leads to program visibility --- computer program integrity
[RSRE-80004] N81-12771

COMPUTER PROGRAMMING
The compilation of regular expressions into integrated circuits
[AD-A090507] N81-12334
Forest resource information system --- St. Regis Paper Co.
[E81-10004] N81-12481
A study of knowledge-based systems for photo interpretation
[AD-A090465] N81-12530
Computer aided control system design. A conversion report
[CRI-110] N81-12752
Comparison of and conversion between different implementations of the FORTRAN programming language
[NASA-TM-81995] N81-12762
Software test models and implementation of associated test drivers
[AD-A089997] N81-12763
An integrated methodology and tools for software development
[AD-A090347] N81-12766
Reference manual for the ADA programming language, proposed standard document
[AD-A090709] N81-12768
Reliable software: Standards for the production of high quality systems --- esa satellites
[ESA-CR(P)-1358] N81-12770
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777
Decidability and expressiveness of logics of processes
[AD-A090688] N81-12788
A computer program for line profile simulations of a laser produced plasma
[CISE-N-187] N81-12901

COMPUTER PROGRAMS
Airport and airspace delay model description
[AD-A090781] N81-12049
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077
Performance seeking controls N81-12092
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
Software standards in chemistry
[LBL-9881] N81-12169
Overlapped subarraying techniques
[AD-A089693] N81-12304
User's manual for large-scale integrated circuit layout check program
[NASA-TM-78192] N81-12325
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452
Earth Observations Division version of the Laboratory for Applications of Remote Sensing System (EOD-LARSYS) user guide for the IBM 370/148. Volume 2: User reference manual
[E81-10010] N81-12487
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
Equivalent source modeling of the main field using Magsat data
[E81-10026] N81-12503
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
A study of knowledge-based systems for photo interpretation
[AD-A090465] N81-12530
A cartographic computer data format and associated programs --- for image processing
[RAE-TR-80037] N81-12539
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
Interdigitated back contact solar cells
[SAND-80-7104] N81-12607
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
A set of computer programs to process turbulence data measured at the 200 m mast at Cabauw, Netherlands
[KNMI-WR-80-3] N81-12706
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
The GMC system for central memory management
[ONERA-NT-1979-12] N81-12751
Data acquisition from a digital voltmeter using a CBM PET 2001 microcomputer with particular reference to microelectronic wire bond testing
[AWRE-O-16/80] N81-12753
Computer storage management. Citations from NTIS data base
[PB80-814759] N81-12758
The PR2D (Place, Route in 2-Dimensions) automatic layout computer program handbook
[NASA-RP-1029] N81-12760
Guidelines in preparing computer-generated plots for NASA technical reports with the LRC graphics output system
[NASA-TM-81908] N81-12761
Software test models and implementation of associated test drivers
[AD-A089997] N81-12763
A comparative analysis of functional correctness
[AD-A090487] N81-12767
Reference manual for the ADA programming language, proposed standard document
[AD-A090709] N81-12768
Automatic scene analysis. Second contract report
[ENST-D-79024] N81-12776
Quadric solids and computational geometry
[BDX-613-2484] N81-12794
Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference
[LBL-9501-VOL-2] N81-12835
Description and utilization of a computation program of the optical radiation transmitted, emitted or diffused by the atmosphere for satellite observation --- spectral domain .3 to 25 microns
[ONERA-NT-1980-3] N81-12878
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891

COMPUTER STORAGE DEVICES
Investigation of multilayer magnetic domain lattice file
[NASA-CR-159324] N81-12745
Read only memories. Citations from the NTIS data base
[PB80-814833] N81-12757
Computer storage management. Citations from NTIS data base
[PB80-814759] N81-12758

COMPUTER SYSTEMS DESIGN
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide
[NASA-CR-152306] N81-12110
Preliminary study on the potential usefulness of array processor techniques for structural synthesis
[NASA-CR-163801] N81-12447
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
DFT decomposition and implementation for concurrent execution on multiple processing elements
[AD-A090725] N81-12748
The design and implementation of the memory manager for a secure archival storage system
[AD-A090313] N81-12749
On developing a theory of distributed computing summary of current research
[AD-A090773] N81-12750
Multipurpose reconfigurable simulator --- computers multiprocessing
[ESS/SS-983] N81-12754
Read only memories. Citations from the NTIS data base
[PB80-814833] N81-12757
Reliable software: Standards for the production of high quality systems --- esa satellites
[ESA-CR(P)-1358] N81-12770
An overview of reliable computer system design
[RSRE-80003] N81-12775
On-line information retrieval systems. Citations from the NTIS data base
[PB80-814841] N81-12934

COMPUTER SYSTEMS PERFORMANCE
A scientific data base for the Royal Aircraft Establishment, Farnborough, England
[RAE-TR-80048] N81-12932

COMPUTER SYSTEMS PROGRAMS
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
Forest resource information system --- St. Regis Paper Co.
[E81-10004] N81-12481
POSER: A Process Organization to Simplify Error Recovery --- fault tolerant real time computer systems
[RSRE-MEMO-3249] N81-12772
Programming language design. Citations from the NTIS data base
[PB80-814767] N81-12773

COMPUTER SYSTEMS SIMULATION
Preliminary study on the potential usefulness of array processor techniques for structural synthesis
[NASA-CR-163801] N81-12447
Multipurpose reconfigurable simulator --- computers multiprocessing
[ESS/SS-983] N81-12754

COMPUTER TECHNIQUES
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484

An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa [E81-10027] N81-12504
Economic analysis procedures for ADP [AD-A089826] N81-12936

COMPUTERIZED DESIGN
C-MOS array design techniques [NASA-CR-150799] N81-12328
Preliminary study on the potential usefulness of array processor techniques for structural synthesis [NASA-CR-163801] N81-12447
GRID and CQUAD: Two preprocessing codes for NASTRAN [AD-A090664] N81-12460
Passive solar design calculations with the DOE-2 computer program [LA-UR-80-2340] N81-12624
The large scale microelectronics Computer-Aided Design and Test (CADAT) system [NASA-TM-78202] N81-12747
Computer aided control system design. A conversion report [CRI-110] N81-12752
The PR2D (Place, Route in 2-Dimensions) automatic layout computer program handbook [NASA-RP-1029] N81-12760

COMPUTERIZED SIMULATION
Naval aircraft operating and support cost-estimating model: FY78 revision [AD-A090044] N81-12013
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds [AD-A090443] N81-12027
Airport and airspace delay model description [AD-A090781] N81-12049
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1 [NASA-CR-163099] N81-12067
Modeling and control of transonic cryogenic wind tunnel: A summary report [NASA-CR-159376] N81-12121
BIRAMIS: Numerical evaluation of the overall system precision --- radiation balance measurements by satellite-borne microaccelerometer [ONERA-RT-7/3373-SY] N81-12159
Multi-mode horn antenna simulation [NASA-TM-80705] N81-12298
Large signal TWT computer theory [AD-A090748] N81-12340
Modeling of compressed magnetic field generators by equivalent circuit approach [AWRE-O-21/80] N81-12351
Improved recursive formula for calculating shock response spectra [SAND-80-1315C] N81-12367
Compact numerical method for the simulation of separated viscous flow, stationary or not. Application [AAAF-NT-80-04] N81-12374
A description of the NSSL cases used for a simulated VAS retrieval study [NASA-TM-82023] N81-12678
A simulation study on the impact of satellite sensed winds on tropical cyclone forecast [AD-A090322] N81-12699
Peripheral cues and color in visual simulation [AD-A089837] N81-12726
Nonlinear chi-square algorithm: An improvement on nonlinear least squares [AD-A090420] N81-12792
A computer program for line profile simulations of a laser produced plasma [CISE-N-187] N81-12901
Hybrid vehicle potential assessment. Volume 9: Power train summary, component descriptions, and HYVEC vehicle simulator [CONS-4209-T1-VOL-9] N81-12949

COMPUTERS
Fiber optic combiner and duplicator [NASA-CR-160044] N81-12864

CONCENTRATING
High efficiency GaAs-GaAlAs solar cells for very high concentration systems [CISE-1517] N81-12630

CONCENTRATION (COMPOSITION)
X-ray fluorescence analysis of metal concentration in an alloy electroplating bath [BDX-613-2411] N81-12205
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
Applications of optical diagnostic techniques in combustion research N81-13013

CONCENTRATORS
Automated linear concentrator cell module assembly [SAND-80-7103] N81-12610
Flat plate solar collector design and performance. Citations from the Engineering Index data base [PB80-814122] N81-12638
Solar energy concentrator design and operation. Citations from the Engineering Index data base [PB80-813934] N81-12642
Fundamentals and techniques of nonimaging optics for solar energy concentration [DOE/ER-10575/1] N81-12874
The DOE photovoltaics program N81-12989

CONCORDE AIRCRAFT
Synthesis of test results obtained with Concorde at high incidences [AAAF-NT-80-26] N81-12079

CONCRETES
Testing program for determining the mechanical properties of concrete to temperatures of 621 C [CONF-800969-1] N81-12459

CONFERENCES
Propulsion Controls, 1979 --- air breathing engine control [NASA-CP-2137] N81-12090
Report on a cooperative programme on Active Flutter Suppression [AGARD-R-689] N81-12115
Software standards in chemistry [LBL-9881] N81-12169
A study of Minnesota land and water resources using remote sensing, volume 13 [E81-10028] N81-12505
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come --- federal and state regulatory burdens and the economic market [DOE/RA-04934/05] N81-12611
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program N81-12708
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference [LBL-9501-VOL-2] N81-12835
Impact for the 80's: Proceedings of a Conference on Selected Technology for Business and Industry [NASA-CP-2149] N81-12978
Testing and measurement techniques in heat transfer and combustion [AGARD-CP-281] N81-12993

CONGRESSIONAL REPORTS
Aviation safety [GPO-68-717] N81-12040
Commuter airport safety [GPO-60-512] N81-12041
Air traffic controllers and flight service station specialists [GPO-51-381] N81-12055
Oversight hearing: United States Metric Board [GPO-56-236] N81-12284
Laser research and applications [GPO-66-074] N81-12406
Priority energy project act of 1979 [GPO-58-154] N81-12555
The Western Hemisphere energy system [GPO-51-683] N81-12557
Agricultural waste products as alternative energy sources [GPO-62-991] N81-12561
Energy research and extension [GPO-61-544] N81-12562
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings [GPO-57-523] N81-12563
Ocean thermal energy conversion act of 1980 [GPO-64-551] N81-12565
Energy from municipal solid wastes [GPO-61-252] N81-12566
Oversight of energy development in Africa and the Middle East [GPO-60-580] N81-12567
Clean air act-amendments of 1977: Oversight [GPO-63-136] N81-12648
The impact of an accelerated coal-based synfuels program on western water resources [GPO-61-316] N81-12649
The magnetic fusion energy program: Its objectives and pace [GPO-56-764] N81-12849
The Moon treaty [GPO-66-705] N81-12937
NASA authorization, 1982 (program review), volume 1 [GPO-68-972] N81-12938
Agreement governing the activities of states on the Moon and other celesial bodies, part 4 [GPO-68-636] N81-12939
Space shuttle and Galileo mission [GPO-53-938] N81-12940
United States civilian space policy [GPO-66-883] N81-12941
Storage batteries for electric vehicle applications [GPO-57-671] N81-12945
Key issues in US-USSR scientific exchanges and technology transfer [GPO-50-111] N81-12946
Technology transfer to China [GPO-58-034] N81-12947
Technology transfer to China [GPO-62-976] N81-12948

CONIFERS
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado [E81-10037] N81-12519

CONJUGATES
An algorithm module for abstract algebra N81-12803

CONSTRUCTION
Development of a new polyurea foam insulation material [EUR-6737-EN] N81-12235
Beam connector apparatus and assembly [NASA-CASE-MFS-25134-1] N81-12283

CONTAINMENT
State-of-the-art review of flywheel burst containment [UCRL-15257] N81-12427

CONTAMINANTS
Kinetics of ionization in NaCl-contaminated argon [LOG-J6857] N81-12188
Reviews of the environmental effects of pollutants: IX, fluoride [ORNL/EIS-85] N81-12660

CONTAMINATION
Experiments on the effect of ultraviolet on contamination in vacuum systems [NASA-TM-81999] N81-12976

CONTENT
Contextual classification of multispectral image data: Approximate algorithm [E81-10038] N81-12520

CONTINENTAL DRIFT
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies [E81-10023] N81-12500

CONTINUOUS RADIATION
Room temperature, CW, single mode laser [AD-A090326] N81-12410

CONTRAST
Some results of preliminary tests on values of sky-sec contrast (visible horizon) as a function of environmental parameters [ESA-TT-623] N81-12691

CONTROL THEORY
Error analysis of pursuit and proportional navigation control laws [AD-A090155] N81-12056
Propulsion Controls, 1979 --- air breathing engine control [NASA-CP-2137] N81-12090
Multivariable identification using centralized fixed modes N81-12091
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
Design of a multivariable integrated control for a supersonic propulsion system --- variable stream control engine N81-12094

Should we attempt global (inlet engine airframe) control design? N81-12097
Propulsion control and control theory: A new research focus N81-12099
Multivariable nyquest array method with application to turbofan engine control N81-12101
Multivariable synthesis with transfer functions — applications to gas turbine engines N81-12102
Alternatives for jet engine control N81-12103
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide [NASA-CR-152306] N81-12110
Report on a cooperative programme on Active Flutter Suppression [AGARD-R-689] N81-12115
Active control of an explosive wing-store flutter case — Langley Research Center N81-12117
Wind tunnel tests on a fighter aircraft wing/store flutter suppression system: The B.Ae control law N81-12119
Optimized pitch controller for load alleviation on wind turbines [FFA-TN-HU-2189-PT-1] N81-12634
An integrated methodology and tools for software development [AD-A090347] N81-12766
Existence of optimal controls for partially observed diffusions [AD-A090537] N81-12778

CONTROLLED FUSION
The magnetic fusion energy program: Its objectives and pace [GPO-56-764] N81-12849
Laser fusion studies at NRL [AD-A090116] N81-12850

CONVECTION
Preliminary designs: Passive solar manufactured housing [DOE/CS-30377/1] N81-12583

CONVECTIVE FLOW
Laser like approach to the dynamics of convective instabilities [CISE-1533] N81-12371

CONVECTIVE HEAT TRANSFER
Approach to performance evaluation of a double wall convective loop house *[BNL-28192] N81-12595*
The use of optical techniques in the interpretation of heat transfer measurements N81-13007

CONVENTIONS
The Moon treaty [GPO-66-705] N81-12937
Agreement governing the activities of states on the Moon and other celesial bodies, part 4 [GPO-66-636] N81-12939

CONVERGENCE
Convergence of iterative nonexpansive signal reconstruction algorithms *[NASA-CR-163799] N81-12790*
Stochastic approximation with discontinuous dynamics and state dependent noise w.p.1 convergence [AD-A089777] N81-12805
Application of MOOT to scattering of elastic waves from compound inclusions *[LA-UR-80-2039] N81-12872*

CONVERGENT-DIVERGENT NOZZLES
Two-phase critical flow of saturated and subcooled liquids through valves [ANL/RAS/LWR-79-7] N81-12370

COOLERS
AVHRR/1-FM Advanced Very High Resolution Radiometer [NASA-CR-160059] N81-12392

COOLING
Laser cooling and trapping of neutral atoms [AD-A090760] N81-12408
Application of model laws when determining the heat transfer coefficients by experiments on cooled turbine blades N81-12998

COOLING SYSTEMS
Technical assistance for the evaluation of fluid loop components (Peltier cooler) *[DS-ERT-14/80] N81-12381*

COORDINATES
Reference coordinate systems for Earth dynamics: A preview *[NASA-CR-163800] N81-12525*

COPOLYMERS
Properties of some diblock copolymers based on 1,3 butadiene monomer [AD-A090144] N81-12230
Polyketones and polysultones for conservation in the ethylene polymer [BNL-51155] N81-12237

COPPER
Ultrasonic seam welding *[BDX-613-2444] N81-12431*

CORN
Houston area multicrop inspection trips — Wharton County, Texas [E81-10003] N81-12480
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans — U.S. Corn Belti Indiana and Iowa [E81-10027] N81-12504
A study of Minnesota land and water resources using remote sensing, volume 13 [E81-10026] N81-12505
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509
Minimum variance geographic sampling [E81-10033] N81-12515
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning — Voves, France [E81-10040] N81-12522

CORRELATION
Correlation of the high-temperature corrosion behavior of structural alloys in coal conversion environments with the components of the alloys and of the corrosive environments [BMI-2059] N81-12213

CORROSION
Study of aluminum corrosion in aluminum solar heat collectors using aqueous glycol solution for heat transfer [DOE/CS-3107/T2] N81-12215
Corrosion and mechanical behavior of materials for coal gasification applications [ANL-80-5] N81-12216
Thin film corrosion [BDX-613-2435] N81-12217
Fatigue crack propagation and corrosion fatigue of AF 1410 steel [AD-A090497] N81-12453
MHD heat and seed recovery technology project [ANL/MHD-80-1] N81-12898

CORROSION PREVENTION
Effect of various surface protections on the stress corrosion behavior of light alloys — aluminum alloys [SNIAS-801-551-102] N81-12220
Flat plate solar collector design and performance. Citations from the NTIS data base [PB80-814130] N81-12639
The use of ion implantation for materials processing [AD-A090714] N81-12903

CORROSION RESISTANCE
Self-lubricating composite materials N81-12984

CORROSION TESTS
Manual for the AGARD-coordinated Corrosion Fatigue Cooperative Testing Program (CFCTP) [NLR-MP-79017-U] N81-12474

COSMIC BACKGROUND EXPLORER SATELLITE
Design studies for a far infrared absolute spectrometer for the cosmic background explorer [NASA-CR-160051] N81-12385

COSMIC RAYS
Future prospects for gamma-ray [NASA-TM-82041] N81-12959
Super-alfvenic propagation of cosmic rays: The role of streaming modes [NASA-TM-82032] N81-12975
Activities of the Space Science Department in 1978/1979 [ESA-SP-1032] N81-12992

COSMOLOGY
Looking for heavier weak bosons with DUMAND [NASA-TM-82027] N81-12828

COST ANALYSIS
Commuter air carrier loan guarantee study [AD-A090815] N81-12047
The development of the composite material engine nacelle [AAAF-NT-79-38] N81-12180
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4 *[DOE/RG-10075/T1] N81-12269*
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary [NASA-CR-163803] N81-12547
GaAlAs/GaAs solar cell process study [NASA-CR-3361] N81-12564
A strategic cost-benefit analysis of energy policies: Overview [BNL-51105] N81-12612
A strategic cost-benefit analysis of energy policies: Detailed projections [BNL-51127] N81-12613
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation *[ANL/ECT-9] N81-12620*
Clean air act-amendments of 1977: Oversight [GPO-63-136] N81-12648

COST EFFECTIVENESS
Evaporation by mechanical vapor recompression [BSDF-38-3Q-80] N81-12195
Deburring: Technical capabilities and cost-effective approaches, lessons 5 and 6 [BDX-613-2382] N81-12288
Development of a low-cost solar panel using laminated polymer films [ALO-4121-2] N81-12577
Solar atrium: A hybrid solar heating and cooling system [DOE/EG-34135/10] N81-12585
Reliability, energy, and cost effects of wind powered generation integrated with a conventional generating system *[ANL/AA-17] N81-12621*
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses *[ERG-031] N81-12632*
Are management problems in the acquisition of aircraft gas turbine engines being corrected [AD-A090520] N81-12928

COST ESTIMATES
Naval aircraft operating and support cost-estimating model: FY78 revision [AD-A090044] N81-12013
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates [NASA-CR-161608] N81-12161
Surface effect vehicle/ships in Marine environments. Citations from the NTIS data base [PB80-814528] N81-12293
Solar total energy modularity study *[SAND-80-7060] N81-12608*
Spent fuel handling and packaging program [DOE/NV-10061/3] N81-12851

COST REDUCTION
Automated linear concentrator cell module assembly *[SAND-80-7103] N81-12610*

COTTON
Houston area multicrop inspection trips — Wharton County, Texas [E81-10003] N81-12480
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm [WMO-532] N81-12707

COULOMB COLLISIONS
The effects of electron-neutral collisions on the intensity of plasma lines [AD-A090749] N81-12887

COULOMB POTENTIAL
C3,4,5(plus) and NCO(plus, minus) molecular ion structure determination by Coulomb explosion [BNL-27326] N81-12844

COUPLING
On the smoothness of Markov chain transition functions *[CTH-MATH-1980-5] N81-12810*

COUPLING CIRCUITS
Non-contacting power transfer device *[NASA-CASE-GSC-12595-1] N81-12331*

COVARIANCE
Equivalent Gaussian measures whose R-N derivative is the exponential of a diagonal form [AD-A090787] N81-12807

CRACK INITIATION
Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456
CRACK PROPAGATION
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232
Crack propagation and deformation in PZT transducer ceramics
[AD-A090569] N81-12234
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452
Fatigue crack propagation and corrosion fatigue of AF 1410 steel
[AD-A090497] N81-12453
Experimental methodology. Application of concepts from mechanics to material rupture studies
[SNIAS-801-551-104] N81-12466
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
Finite element analysis of crack growth
[NLR-MP-78017-U] N81-12802
CRACKING (FRACTURING)
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232
Acoustic emission of carbon fiber reinforced plastics
[FOK-R-2464] N81-12250
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256
Fatigue crack propagation and corrosion fatigue of AF 1410 steel
[AD-A090497] N81-12453
Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455
Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456
CREEP ANALYSIS
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
CREEP DIAGRAMS
Progress toward analytical description of the creep strain-time behavior engineering alloys
[CONF-800907-2] N81-12214
CREEP PROPERTIES
Progress toward analytical description of the creep strain-time behavior engineering alloys
[CONF-800907-2] N81-12214
CREEP RUPTURE STRENGTH
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
CREEP TESTS
A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462
CRITERIA
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
CRITICAL FLOW
Two-phase critical flow of saturated and subcooled liquids through valves
[ANL/RAS/LWR-79-7] N81-12370
CRITICAL LOADING
Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
CRITICAL TEMPERATURE
Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924
CROP GROWTH
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
Sorghums as energy crops
[CONF-800482-5] N81-12534
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
Proceedings of the International Workshop of the Effects of acid precipitation vegetation, soils, and terrestrial ecosystems
[BNL-51195] N81-12661
CROP IDENTIFICATION
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belt Indiana and Iowa
[E81-10027] N81-12504
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
Remote sensing of agricultural resources. Citations from the NTIS data base
[PB80-814981] N81-12541
CROP INVENTORIES
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Minimum variance geographic sampling
[E81-10033] N81-12515
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Stratum variance estimation for sample allocation in crop surveys --- Great Plains Corridor
[E81-10035] N81-12517
CROP VIGOR
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509
CROPS
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
CRUDE OIL
Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533
International energy indicators --- coal, crude oil, nuclear generation capacity petroleum products
[DOE/IA-0010/2] N81-12588
CRUISE MISSILES
Astroinertial navigation for cruise applications
[AD-A090649] N81-12059
CRYOGENIC WIND TUNNELS
Effects of boundary-layer treatment on cryogenic wind-tunnel controls
[NASA-CR-159372] N81-12120
Modeling and control of transonic cryogenic wind tunnel: A summary report
[NASA-CR-159376] N81-12121
CRYSTAL GROWTH
Sequential purification and crystal growth for the production of low cost silicon substrates
[DOE/SERI/8229-3/2-T6] N81-12602
Large high quality single crystal aluminum phosphate for acoustic wave devices
[AD-A090359] N81-12905
CRYSTAL OSCILLATORS
Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields
[AD-A090361] N81-12332
Investigation into the sensitive parameters in a quartz oscillator
[ESA-TT-636] N81-12352
CRYSTAL STRUCTURE
Simulation of the structure of vacancies in high angle grain boundaries
[COO-5002-10] N81-12919
CRYSTALLOGRAPHY
Czochralski growth of single-crystal gehlenite Ca2Al2SiO7
[CONF-800908-2] N81-12921
CUBIC EQUATIONS
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection
[NASA-TM-81998] N81-12528
CULTIVATION
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
CURING
Conveyorized radio frequency cure of epoxy glass composites
[AD-A089728] N81-12176
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
CURRENT REGULATORS
Three phase power factor controller
[NASA-CASE-MFS-25535-1] N81-12330
CUTTING
Laser cutting plastic materials
[BDX-613-2476] N81-12417
CYBERNETICS
Automatic scene analysis. Second contract report
[ENST-D-79024] N81-12776
CYCLIC LOADS
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
CYCLONES
A simulation study on the impact of satellite sensed winds on tropical cyclone forecast
[AD-A090322] N81-12699
CYCLOPROPANE
A reinvestigation of transients in the cyclopropane system by the variable encounter method
[AD-A090168] N81-12228
CYCLOTRONS
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
CYLINDRICAL BODIES
A new method of roundness measurement by capacitative detectors
[ESA-TT-635] N81-12292
In-flight boundary-layer measurements on a hollow cylinder at a Mach number of 3.0
[NASA-TP-1764] N81-12361
Compact numerical method for the simulation of separated viscous flow, stationary or not. Application
[AAAF-NT-80-04] N81-12374
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12897
CYLINDRICAL CHAMBERS
Modified spiral wound retaining ring
[NASA-CASE-LAR-12381-1] N81-12422
CYLINDRICAL PLASMAS
Lower-hybrid-drift instability with axis encircling ions
[SAI-254-80-477-LJ] N81-12893
CZOCHRALSKI METHOD
Solar silicon via the Dow Corning process
[NASA-CR-163798] N81-12551

Czochralski growth of single-crystal gehlenite $Ca_2Al_2SiO_7$
[CONF-800908-2] N81-12921

D

DAMAGE ASSESSMENT
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
DAMPING
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142
DAMS
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come --- federal and state regulatory burdens and the economic market
[DOE/RA-04934/05] N81-12611
DATA ACQUISITION
A computer based ionospheric sounding and HF noise measuring system
[ERL-0146-TR] N81-12299
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
Remote sensing and image interpretation
[E81-10036] N81-12518
Low cost, bare plate solar air collector
[DOE/R5-10143/1] N81-12605
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
Data acquisition from a digital voltmeter using a CBM PET 2001 microcomputer with particular reference to microelectronic wire bond testing
[AWRE-O-16/80] N81-12753
DATA BASES
Commuter air carrier loan guarantee study
[AD-A090615] N81-12047
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
Nondestructive testing information analysis center, 1979
[AD-A090718] N81-12442
An integrated methodology and tools for software development
[AD-A090347] N81-12766
Are management problems in the acquisition of aircraft gas turbine engines being corrected
[AD-A090520] N81-12928
DATA CONVERSION ROUTINES
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
DATA LINKS
Optimal resource placement in a distributed system (extended abstract)
[AD-A090772] N81-12780
DATA MANAGEMENT
The GMC system for central memory management
[ONERA-NT-1979-12] N81-12751
A scientific data base for the Royal Aircraft Establishment, Farnborough, England
[RAE-TR-80048] N81-12932
DATA PROCESSING
Coding and processing for reliable data transmission
[AD-A090406] N81-12315
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
Manual on the global data processing system. Volume 2: Regional aspects --- World Meteorological Organization
[WMO-485-VOL-2] N81-12714
DATA PROCESSING EQUIPMENT
DYMAC digital electronic balance
[LA-8313-M] N81-12398
DATA PROCESSING TERMINALS
Automatic construction of semantic networks
[BMFT-FB-ID-79-05] N81-12781
DATA REDUCTION
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
DATA SAMPLING
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Minimum variance geographic sampling
[E81-10033] N81-12515
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Stratum variance estimation for sample allocation in crop surveys --- Great Plains Corridor
[E81-10035] N81-12517
DATA SMOOTHING
On the smoothness of Markov chain transition functions
[CTH-MATH-1980-5] N81-12810
DATA STORAGE
A cartographic computer data format and associated programs --- for image processing
[RAE-TR-80037] N81-12539
The design and implementation of the memory manager for a secure archival storage system
[AD-A090313] N81-12749
The GMC system for central memory management
[ONERA-NT-1979-12] N81-12751
DATA SYSTEMS
Development of hybrid circuits, a summary
[ESA-CR(P)-1243-REV-B] N81-12350
Study of the operational deployment of SIRIO-2 ground stations. Volume 1 --- meteorological data traffic
[ESA-CR(P)-1369-VOL-1] N81-12711
A scientific data base for the Royal Aircraft Establishment, Farnborough, England
[RAE-TR-80048] N81-12932
DATA TRANSMISSION
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967 - 1980 reference book, volume 1
[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137
A uniform representation of single and multi-stage interconnection networks used in SIMD machines
[AD-A089688] N81-12300
Coding and processing for reliable data transmission
[AD-A090406] N81-12315
DAYTIME
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
DC 10 AIRCRAFT
AEROMEXICO DC-10-30, XA-DUH, over Luxembourg, Europe
[NTSB-AAR-80-10] N81-12042
DE BROGLIE WAVELENGTHS
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853
DECAMETRIC WAVES
The formation of arcs in the dynamic spectra of Jovian decameter bursts
[NASA-TM-81987] N81-12966
DECEPTION
Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720
DECISION MAKING
Economic analysis procedures for ADP
[AD-A089826] N81-12936
DECISION THEORY
Failure detection system design methodology
[NASA-CR-163792] N81-12439
DECODING
The multiple stack algorithm implemented on a Zilog Z-80 microcomputer
[AD-A090606] N81-12791
DECOMPOSITION
The decomposition of N2O on Ni (110)
[AD-A090552] N81-12193
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831
DECOMPRESSION SICKNESS
XDC-2 digital decompression computer: Assessment of decompression profiles by ultrasonic monitoring, phase 1, 36-54 MSW
[AD-A090467] N81-12729
Hyperbaric oxygenation. Citations from the NTIS data base
[PB80-813769] N81-12735
DEFENSE INDUSTRY
Nondestructive testing of armament-system components by means of neutron diffraction
[AD-A090433] N81-12443
DEFLAGRATION
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
DEFLECTION
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
DEFORMATION
Crack propagation and deformation in PZT transducer ceramics
[AD-A090569] N81-12234
DEGRADATION
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454
DEGREES OF FREEDOM
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083
DELAMINATING
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
DENSITY (MASS/VOLUME)
Electron beam measurements of the density in a hypersonic turbulent boundary layer at M = 9
[IC-AERO-80-01] N81-12378
DENSITY DISTRIBUTION
Effect of rawinsonde errors on rocketsonde density and pressure profiles: An error analysis of the Rawinsonde System
[NASA-CR-156873] N81-12677
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
DENSITY MEASUREMENT
Electron beam measurements of the density in a hypersonic turbulent boundary layer at M = 9
[IC-AERO-80-01] N81-12378
Probe measurements in multi-dimensional reacting flows N81-12997
DENTISTRY
Acoustic tooth cleaner
[NASA-CASE-LAR-12471-1] N81-12724
DEOXYRIBONUCLEIC ACID
Mechanisms of recombination and function of DNA in bacteria
[DOE/EV-03941/52] N81-12721

DEPLOYMENT
Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727
DESCENT TRAJECTORIES
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
Interlevel correlations of temperature and density, surface to 60 km
[AD-A090515] N81-12130
DESIGN ANALYSIS
The changing scene of structural airworthiness
[AAAF-NT-79-24] N81-12076
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083
BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128
BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129
Progress toward analytical description of the creep strain-time behavior engineering alloys
[CONF-800907-2] N81-12214
Studies of the mechanisms of coal hydrogenation by electron spin resonance
[DOE/PC-30072/T1] N81-12272
Study of heat rejection systems --- in Spacelab
[TC-80-TR-0050] N81-12379
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433
Preliminary designs: Passive solar manufactured housing
[DOE/CS-30377/1] N81-12583
Solar atrium: A hybrid solar heating and cooling system
[DOE/EG-34135/10] N81-12585
Approach to performance evaluation of a double wall convective loop house
[BNL-28192] N81-12595
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses
[ERG-031] N81-12632
Application of a method for aerodynamic analysis and design of horizontal axis wind turbines, part 1
[FFA-TN-AU-1499-PT-1] N81-12633
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
Vehicle systems design optimization study
[NASA-CR-163797] N81-12944
DESULFURIZING
Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203
DETECTION
Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870
DETONATION
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
DETONATION WAVES
A reaction mechanism in the shock initiation of detonation: A theoretical study
[AD-A090357] N81-12264
DEUTERIUM
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910
DIATOMIC MOLECULES
Excimer potential curves
[AD-A090516] N81-12414
DIELECTRICS
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303
Electromagnetic waves scattering by buried dielectric objects
[AD-A090582] N81-12308
DIFFERENTIAL EQUATIONS
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891
DIFFERENTIAL GEOMETRY
Quadric solids and computational geometry
[BDX-613-2484] N81-12794
DIFFERENTIAL THERMAL ANALYSIS
Approach to performance evaluation of a double wall convective loop house
[BNL-28192] N81-12595
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
[AERONOMICA-ACTA-A-206-1979] N81-12670
DIFFRACTION
Diffractive hadron dissociation at 100 and 200 GeV
[DOE/ER-02232/89] N81-12837
DIFFUSION
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778
DIFFUSION COEFFICIENT
On eddy diffusion coefficients --- in atmospheric models
[AERONOMICA-ACTA-A-212-1980] N81-12672
DIFFUSION FLAMES
Correlation measurement of velocity and temperature fluctuations in a free jet diffusion flame N81-13002
Velocity and turbulence measurements in turbulent flames using the L2F technique N81-13003
The study of turbulent diffusion flames: Modeling needs and experimental light scattering capabilities N81-13011
DIGITAL COMMAND SYSTEMS
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067
DIGITAL DATA
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission) --- Yerington, Nevada mine area
[E81-10018] N81-12495
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
DIGITAL FILTERS
Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection --- detecting aircraft from satellites
[AD-A090644] N81-12146
Applications of efficient subset selection to digital filtering and to signal resolution
[AD-A090128] N81-12813
DIGITAL SYSTEMS
Propulsion controls N81-12095
Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096
Improved methods for computing drag corrected missile impact predictions in real time
[AD-A090413] N81-12145
SWIFT
[AD-A090647] N81-12343
Development of Boolean calculus and its applications --- digital systems design
[NASA-CR-163802] N81-12786
DIGITAL TECHNIQUES
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
An integrated methodology and tools for software development
[AD-A090347] N81-12766
Search for faint galactic features --- digital image processing
[LA-UR-80-2357] N81-12960
DIODES
Vector-potential flow in relativistic beam diodes
[NRL-MR-4326] N81-12857
DIPOLE ANTENNAS
An analysis of the various methods used to analyze radiation from the thin wire E field integral equation
[AD-A090488] N81-12307
DIRECTIONAL SOLIDIFICATION (CRYSTALS)
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
DIRECTIONAL STABILITY
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113
DIRECTIVITY
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387
DISCONTINUITY
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
DISEASES
Effect of ionizing radiations on connective tissue
[UR-3490-1900] N81-12732
DISPERSION
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675
DISPLACEMENT
Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252
Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467
DISPLAY DEVICES
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
Tactical video display
[AD-A089992] N81-12302
Development of an electrophoretic image display
[AD-A090574] N81-12396
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880
Research in multi-color thin film emitters
[AD-A090472] N81-12908
DISSOCIATION
Diffractive hadron dissociation at 100 and 200 GeV
[DOE/ER-02232/89] N81-12837
DISTANCE
Minimum variance geographic sampling
[E81-10033] N81-12515
DISTANCE MEASURING EQUIPMENT
High accuracy distance measurement by two-wavelength pulsed laser source
[CISE-N-189] N81-12419
DISTRICT OF COLUMBIA
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
DIURNAL VARIATIONS
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
DIVERGENT NOZZLES
Calculations for nonstationary laminar flow subject to an average deceleration with shearing
[AAAF-NT-80-02] N81-12373
DIVING (UNDERWATER)
XDC-2 digital decompression computer: Assessment of decompression profiles by ultrasonic monitoring, phase 1, 36-54 MSW
[AD-A090467] N81-12729

DOCUMENT STORAGE
Holographic associative memories in document retrieval systems
[BMFT-FB-DV-79-05] N81-12931
DOMESTIC ENERGY
Priority energy project act of 1979
[GPO-58-154] N81-12555
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings --- bibliographies
[DOE/IR-06065/1-PT-1] N81-12582
DOPED CRYSTALS
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925
DOPPLER EFFECT
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 1
[NASA-CR-161611] N81-12697
DOPPLER NAVIGATION
Army GPS-doppler hybrid navigation system
[AD-A090394] N81-12062
DOPPLER RADAR
Acoustoelectric devices: A new technology for waveform-agile radar
[AD-A090646] N81-12311
A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314
DOSIMETERS
Miniature spectrally selective dosimeter
[NASA-CASE-LAR-12469-1] N81-12388
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731
DOUBLE BASE ROCKET PROPELLANTS
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256
DRAG
Three component measurements on a body with various afterbody configurations in subsonic and transonic flow
[ESA-TT-626] N81-12151
DRAG REDUCTION
Assessment of variable camber for application to transport aircraft
[NASA-CR-158430] N81-12016
Aircraft surface coatings study: Energy efficient transport program --- sprayed and adhesive bonded coatings for drag reduction
[NASA-CR-158954] N81-12225
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
DROP SIZE
Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411
DROPS (LIQUIDS)
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004
Droplet size measurements in combustion by the visibility method N81-13014
DUCTED FLOW
Acoustic transmission matrix of a variable area duct or nozzle carrying a compressible subsonic flow
[NASA-TM-81614] N81-12821
DUCTS
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
DUMPING
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
DYNAMIC LOADS
Geostationary platform systems concepts definition follow-on study. Volume 2A: Technical Task 2 LSST special emphasis
[NASA-CR-161597] N81-12133
A comparison of methods for calibration and use of multi-component strain gauge wind tunnel balances
[AD-A090484] N81-12394
Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471
DYNAMIC PROGRAMMING
Some aspects on improvements of a first-order dynamic optimization algorithm
[SAAB-TN-AE-73] N81-12769
DYNAMIC RESPONSE
Contact law and impact responses of laminated composites
[NASA-CR-159884] N81-12172
Proceedings of the Army symposium on solid mechanics. Designing for extremes: Environment, Loading, and Structural Behavior
[AD-A090684] N81-12285
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005
DYNAMIC STRUCTURAL ANALYSIS
Finite element analysis of a dynamically loaded flat laminated plate
[AD-A089985] N81-12787

E

EARPHONES
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
EARTH (PLANET)
Reference coordinate systems for Earth dynamics: A preview
[NASA-CR-163800] N81-12525
EARTH ATMOSPHERE
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
[AERONOMICA-ACTA-A-206-1979] N81-12670
Theoretical regime diagrams for thermally driven flows in a beta-plane channel in the presence of variable gravity
[NASA-TM-78316] N81-12676
EARTH CRUST
Crustal dynamics project observing plan for highly mobile systems 1981 - 1986
[NASA-TM-82029] N81-12680
EARTH RESOURCES
Space activities in Finland in 1979 N81-12126
A digital systematic classification of ecosystems with an illustrated summary of the natural vegetation of North America
[PB80-194020] N81-12532
EARTH SURFACE
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
[AERONOMICA-ACTA-A-206-1979] N81-12670
EARTHQUAKE RESISTANT STRUCTURES
Seismic response analysis for structures with non-orthogonal modes
[DP-MS/79-78] N81-12290
EARTHQUAKES
The 1976 earthquake sequence in Uzbekistan: Focal mechanisms determined using the relative amplitude method
[AWRE-O-27/80] N81-12692
ECHOES
Atmospheric echo sounding. Citations from the NTIS data base
[PB80-815004] N81-12694
ECLIPSES
Groundbased predictors of spacecraft charging during eclipse passage
[AD-A090338] N81-12148
ECOLOGY
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
ECONOMETRICS
Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039
ECONOMIC ANALYSIS
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618
Economic analysis procedures for ADP
[AD-A089826] N81-12936
ECONOMIC FACTORS
US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come --- federal and state regulatory burdens and the economic market
[DOE/RA-04934/05] N81-12611
ECONOMIC IMPACT
Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039
ECOSYSTEMS
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
A digital systematic classification of ecosystems with an illustrated summary of the natural vegetation of North America
[PB80-194020] N81-12532
Proceedings of the International Workshop of the Effects of acid precipitation vegetation, soils, and terrestrial ecosystems
[BNL-51195] N81-12661
EDUCATION
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings --- bibliographies
[DOE/IR-06065/1-PT-1] N81-12582
EFFICIENCY
Induced drag ideal efficiency factor of arbitrary lateral-vertical wing forms
[NASA-CR-3357] N81-12022
EFFLUENTS
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
EFFUSIVES
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675
ELASTIC ANISOTROPY
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic liquid crystals
[NASA-TM-81628] N81-12817
ELASTIC SCATTERING
Diffractive hadron dissociation at 100 and 200 GeV
[DOE/ER-02232/89] N81-12837
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853
ELASTIC WAVES
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872
ELASTOMERS
Heat resistant plastics: Silicone, carborane, halocarbon, and other polymers. Citations from the NTIS data base
[PB80-814734] N81-12253
ELECTRIC ARCS
The use of an arc image furnance for solid propellant ignition studies. An undergraduate student report
[PERME-MEMO-111] N81-12282
ELECTRIC AUTOMOBILES
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
Vehicle systems design optimization study
[NASA-CR-163797] N81-12944
Storage batteries for electric vehicle applications
[GPO-57-671] N81-12945

Hybrid vehicle potential assessment. Volume 9: Power train summary, component descriptions, and HYVEC vehicle simulator
[CONS-4209-T1-VOL-9] N81-12949
Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950

ELECTRIC BATTERIES
Insulation development for high-temperature batteries for electric vehicle application
[CONS-5160-T1] N81-12571
High-performance batteries for electric-vehicle propulsion and stationary energy storage
[ANL-79-94] N81-12614
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615

ELECTRIC DISCHARGES
Effect of hole geometry and Electric-Discharge Machining (EDM) on airflow rates through small diameter holes in turbine blade material
[NASA-TP-1716] N81-12089
Spacecraft charging on ATS-5
[AD-A090508] N81-12147

ELECTRIC ENERGY STORAGE
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618

ELECTRIC EQUIPMENT TESTS
Microwave integrated circuits procedures evaluation
[AD-A090677] N81-12338

ELECTRIC FIELD STRENGTH
A comparison between electric field strengths similarly generated and measured in the open air, in a shielded enclosure and in a large aircraft hangar, over frequency range 10 to 110 MHz
[RSRE-MEMO-3248] N81-12353

ELECTRIC FIELDS
An analysis of the various methods used to analyze radiation from the thin wire E field integral equation
[AD-A090488] N81-12307
Effect of a dc electric field on the trapping dynamics of a cold electron beam
[AD-A090810] N81-12888

ELECTRIC GENERATORS
Ocean thermal energy conversion act of 1980
[GPO-64-551] N81-12565
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
Fuel cells. Citations from the NTIS data base
[PB80-813389] N81-12641
Large wind turbines: A utility option for the generation of electricity N81-12981

ELECTRIC HYBRID VEHICLES
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
Hybrid vehicle potential assessment. Volume 9: Power train summary, component descriptions, and HYVEC vehicle simulator
[CONS-4209-T1-VOL-9] N81-12949
Impact for the 80's: Proceedings of a Conference on Selected Technology for Business and Industry
[NASA-CP-2149] N81-12978
Propulsion system research and development for electric and hybrid vehicles N81-12985
The Federal electric and hybrid vehicle program N81-12986
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987

ELECTRIC MOTOR VEHICLES
Development of evaluation techniques for electrochemical energy storage systems
[CONS-5157-T1] N81-12589
High-performance batteries for electric-vehicle propulsion and stationary energy storage
[ANL-79-94] N81-12614
Vehicle systems design optimization study
[NASA-CR-163797] N81-12944
Storage batteries for electric vehicle applications
[GPO-57-671] N81-12945
Energy aspects of designing electric automobiles and electrical transmissions for them
[DOE-TR-229] N81-12951
Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953
Research, development and demonstration of lead-acid batteries for electric vehicle propulsion
[ANL/OEPM-79-7] N81-12954
Impact for the 80's: Proceedings of a Conference on Selected Technology for Business and Industry
[NASA-CP-2149] N81-12978
Propulsion system research and development for electric and hybrid vehicles N81-12985
The Federal electric and hybrid vehicle program N81-12986

ELECTRIC POWER PLANTS
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547
Point Focusing Thermal and Electric Applications Project. Volume 2: Workshop proceedings
[NASA-CR-163804] N81-12548
Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600
Coal gasifier cogeneration powerplant project N81-12988

ELECTRIC POWER TRANSMISSION
Electrical fault location. Citations from the Engineering Index data base
[PB80-813652] N81-12354

ELECTRIC SWITCHES
Pulse power switch development
[AD-A090511] N81-12339

ELECTRICAL ENGINEERING
Tactical video display
[AD-A089992] N81-12302
Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950

ELECTRICAL FAULTS
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236
Electrical fault location. Citations from the Engineering Index data base
[PB80-813652] N81-12354

ELECTRICAL MEASUREMENT
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389

ELECTRICAL PROPERTIES
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200

ELECTRICAL RESISTANCE
Solar cell utilizing photochemical generation of electricity
[DOE/R5-10114/1] N81-12581

ELECTRO-OPTICS
Feasibility study of an integrated optic switching center --- satellite tracking application
[NASA-CR-160042] N81-12863

ELECTROACOUSTIC TRANSDUCERS
Acoustoelectric devices: A new technology for waveform-agile radar
[AD-A090646] N81-12311

ELECTROCATALYSTS
Fuel cells. Citations from the NTIS data base
[PB80-813397] N81-12640

ELECTROCHEMISTRY
The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569
Development of evaluation techniques for electrochemical energy storage systems
[CONS-5157-T1] N81-12589
Fuel cells. Citations from the NTIS data base
[PB80-813397] N81-12640

ELECTRODE FILM BARRIERS
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597

ELECTRODEPOSITION
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564

ELECTRODES
The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568
Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953

ELECTROLUMINESCENCE
Tactical video display
[AD-A089992] N81-12302
Research in multi-color thin film emitters
[AD-A090472] N81-12908

ELECTROLYTES
The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568
Production technology of beta-alumina ceramics for Na/S batteries
[BMFT-FB-T-79-57] N81-12629

ELECTROLYTIC CELLS
A preliminary investigation of the behavior of titanium-lead dioxide electrodes
[ECRC/M1266] N81-12349

ELECTROMAGNETIC ABSORPTION
Graphs of the cross sections in the Alternate Monte Carlo Cross Section library at the Los Alamos Scientific Laboratory
[LA-8394-MS] N81-12793
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922

ELECTROMAGNETIC FIELDS
Vector analogues of the Maggi-Rubinowicz theory of edge diffraction
[NASA-TM-82024] N81-12297

ELECTROMAGNETIC INTERACTIONS
Micom program in optical bistability
[AD-A090366] N81-12865

ELECTROMAGNETIC RADIATION
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303

ELECTROMAGNETIC SCATTERING
Electromagnetic waves scattering by buried dielectric objects
[AD-A090582] N81-12308
Theoretical and experimental study of radar scattering and simulation. Part 1: Theory
[AD-A090500] N81-12310

ELECTROMAGNETIC SURFACE WAVES
Surface nonlinear optics
[LBL-11252] N81-12875

ELECTROMAGNETIC WAVE TRANSMISSION
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886

ELECTROMETERS
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389

ELECTRON BEAMS
Gigawatt microwave emission from a relativistic reflex triode
[AD-A090598] N81-12335
Fundamental limitations of electron beam lithography for future military IC fabrication
[AD-A090407] N81-12336
Electron beam measurements of the density in a hypersonic turbulent boundary layer at M = 9
[IC-AERO-80-01] N81-12378
Effect of a dc electric field on the trapping dynamics of a cold electron beam
[AD-A090810] N81-12888

ELECTRON CYCLOTRON HEATING
Wave propagation in a temperate plasma having n ions species
[IPF-78-7] N81-12899
ELECTRON DENSITY (CONCENTRATION)
Electrotransport of solutes in refractory metals
[IS-4722] N81-12218
ELECTRON ENERGY
Electronic excitation in molecular collisions structural dynamic and kinetic considerations
[AD-A090287] N81-12833
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
ELECTRON MICROSCOPES
Mass measurement with the electron microscope
[BNL-25536] N81-12400
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457
ELECTRON MOBILITY
Electrotransport of solutes in refractory metals
[IS-4722] N81-12218
ELECTRON PARAMAGNETIC RESONANCE
Studies of the mechanisms of coal hydrogenation by electron spin resonance
[DOE/PC-30072/T1] N81-12272
ELECTRON PHONON INTERACTIONS
Rigid muffin-tin approximation for the electron-phonon interaction in transition metals
[CONF-800864-1] N81-12839
ELECTRON PHOTON CASCADES
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922
ELECTRON RADIATION
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
ELECTRON SCATTERING
Mass measurement with the electron microscope
[BNL-25536] N81-12400
Trapped electron modifications to tearing modes in the low collision frequency limit
[SAI-245-80-348-LJ] N81-12846
The effects of electron-neutral collisions on the intensity of plasma lines
[AD-A090749] N81-12887
ELECTRON STATES
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679
ELECTRON TRANSFER
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912
ELECTRON TRANSITIONS
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
ELECTRONIC CONTROL
Current and future needs for engine electronic control sensors N81-12435
ELECTRONIC EQUIPMENT
SWIFT
[AD-A090647] N81-12343
Electrical fault location. Citations from the Engineering Index data base
[PB80-813652] N81-12354
AMARV high reliability piece part
[AD-A090577] N81-12441
Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870
ELECTRONIC EQUIPMENT TESTS
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
A comparison between electric field strengths similarly generated and measured in the open air, in a shielded enclosure and in a large aircraft hangar, over frequency range 10 to 110 MHz
[RSRE-MEMO-3248] N81-12353
ELECTRONIC MODULES
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
ELECTROPHORESIS
Development of an electrophoretic image display
[AD-A090574] N81-12396
ELECTROPLATING
X-ray fluorescence analysis of metal concentration in an alloy electroplating bath
[BDX-613-2411] N81-12205
ELECTROSTATIC WAVES
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
ELECTROSTATICS
Lower-hybrid-drift instability with axis encircling ions
[SAI-254-80-477-LJ] N81-12893
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12897
ELECTROTHERMAL ENGINES
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164
ELLIPTICITY
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B
[RAE-TR-80052] N81-12693
EMBRITTLEMENT
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256
EMERGENCY LIFE SUSTAINING SYSTEMS
Performance of the Scott Aviox emergency oxygen system after exposure to normal, hot and cold storage conditions
[AD-A090572] N81-12738
EMISSION SPECTRA
Excimer potential curves
[AD-A090516] N81-12414
Line shapes in laser experiments
[AD-A090766] N81-12415
On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973
EMITTANCE
Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401
EMITTERS
Research in multi-color thin film emitters
[AD-A090472] N81-12908
EMULSIONS
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
ENCAPSULATING
Spent fuel handling and packaging program
[DOE/NV-10061/3] N81-12851
ENERGETIC PARTICLES
Energetic particles in the pre-dawn magnetotail of Jupiter
[NASA-TM-81991] N81-12967
ENERGY BANDS
Electronic band structure and optical properties of the cubic, Sc, Y and La hydride systems
[IS-T-899] N81-12918
ENERGY BUDGETS
BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128
BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129
BIRAMIS: Numerical evaluation of the overall system precision --- radiation balance measurements by satellite-borne microaccelerometer
[ONERA-RT-7/3373-SY] N81-12159
ENERGY CONSERVATION
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings
[GPO-57-523] N81-12563
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings --- bibliographies
[DOE/IR-06065/1-PT-1] N81-12582
A strategic cost-benefit analysis of energy policies: Overview
[BNL-51105] N81-12612
A strategic cost-benefit analysis of energy policies: Detailed projections
[BNL-51127] N81-12613
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813793] N81-12636
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813785] N81-12637
Energy-environmental impacts of five energy conservation measures in the middle Atlantic and Pacific states
[BNL-51110] N81-12662
ENERGY CONSUMPTION
Energy-environmental impacts of five energy conservation measures in the middle Atlantic and Pacific states
[BNL-51110] N81-12662
ENERGY CONVERSION
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4
[DOE/RG-10075/T1] N81-12269
Satellite power system concept development and evaluation program. Volume 1: Technical assessment summary report
[NASA-TM-58232] N81-12543
Energy from municipal solid wastes
[GPO-61-252] N81-12566
Energy overview N81-12979
Large wind turbines: A utility option for the generation of electricity N81-12981
ENERGY CONVERSION EFFICIENCY
Three dimensional non-linear theory of the free electron laser
[AD-A090321] N81-12409
Development of high efficiency (14 percent) solar cell array module
[NASA-CR-163808] N81-12553
Ocean thermal energy conversion act of 1980
[GPO-64-551] N81-12565
ENERGY LEVELS
Search for direct photon production at Fermilab energies and comparison with direct photon measurements at ISR energies
[FERMILAB-CONF-79/85-EXP] N81-12843
ENERGY POLICY
Solar power satellites. A review of the space transportation options
[RAE-TR-80034] N81-12153
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
Alternative transportation fuels
[CONF-800419-5] N81-12267
Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268
Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533
Sorghums as energy crops
[CONF-800482-5] N81-12534
Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
Energy: A continuing bibliography with indexes
[NASA-SP-7043(22)] N81-12559
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560

Energy research and extension
[GPO-61-544] N81-12562
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings
[GPO-57-523] N81-12563
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564
Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572
Open cycle OTEC system with falling jet evaporator and condenser
[SERI/TP-631-791] N81-12573
Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579
Wind energy systems: Program summary
[DOE/CS-20097/01] N81-12580
Solar cell utilizing photochemical generation of electricity
[DOE/R5-10114/1] N81-12581
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings --- bibliographies
[DOE/IR-06065/1-PT-1] N81-12582
DOD-DOE Workshop on Joint Energy Activities
[CONF-800383] N81-12590
Energy use in office buildings. Volume 1: Analysis of 1977 office building energy use as reported in the Building Owners and Managers Association Data Base
[DOE/CS-20189/1] N81-12593
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
Wave power extraction from a transient heaving cylinder
[DOE/ET-21019/T1] N81-12599
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells
[DOE/ET-23108/4] N81-12601
Low cost thin film polycrystalline silicon solar cells
[DOE/ET-23048/T1] N81-12603
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
Interdigitated back contact solar cells
[SAND-80-7104] N81-12607
Heliostat mirror survey and analysis
[PNL-3194] N81-12609
Automated linear concentrator cell module assembly
[SAND-80-7103] N81-12610
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come --- federal and state regulatory burdens and the economic market
[DOE/RA-04934/05] N81-12611
A strategic cost-benefit analysis of energy policies: Overview
[BNL-51105] N81-12612
A strategic cost-benefit analysis of energy policies: Detailed projections
[BNL-51127] N81-12613
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses
[ERG-031] N81-12632
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813793] N81-12636
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813785] N81-12637
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655
In pursuit of clean air: A data book of problems and strategies at the state level. Volume 3: Federal regions 4 and 6
[ANL/EES-TM-90-VOL-3] N81-12656
Geothermal energy environmental problems and control methods: Review of recent findings
[DOE/ET-27224/T1] N81-12658
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659
Energy-environmental impacts of five energy conservation measures in the middle Atlantic and Pacific states
[BNL-51110] N81-12662
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
Bag model, the hyperspherical formalism and the heavy baryons
[BNL-28198] N81-12836
Neutral beam development plan
[DOE/ER-0075] N81-12856
A reactor study on a belt-shaped screw pinch --- configuration
[REPT-73-76] N81-12902
Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950
Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952
Energy overview N81-12979
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987
Coal gasifier cogeneration powerplant project N81-12988
The DOE photovoltaics program N81-12989
Solar photovoltaics: Stand alone applications --- NASA Lewis Research Center research and development N81-12990

ENERGY REQUIREMENTS

Energy use in office buildings. Volume 1: Analysis of 1977 office building energy use as reported in the Building Owners and Managers Association Data Base
[DOE/CS-20189/1] N81-12593

ENERGY SOURCES

Thermochemical cycles: A new method of producing hydrogen
[LASL-80-26] N81-12275

ENERGY SPECTRA

An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296

ENERGY STORAGE

Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Development of evaluation techniques for electrochemical energy storage systems
[CONS-5157-T1] N81-12589
High-performance batteries for electric-vehicle propulsion and stationary energy storage
[ANL-79-94] N81-12614
Argonne solar energy program. Summary of solar program activities
[ANL-80-80] N81-12622

ENERGY TECHNOLOGY

Alternative process schemes for coal conversion
[BNL-51233] N81-12278
Analytical investigation of critical phenomena in MHD power generators
[NASA-CR-165143] N81-12546
The Western Hemisphere energy system
[GPO-51-683] N81-12557
Energy: A continuing bibliography with indexes
[NASA-SP-7043(22)] N81-12559
Energy research and extension
[GPO-61-544] N81-12562
Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567
Reliability, energy, and cost effects of wind powered generation integrated with a conventional generating system
[ANL/AA-17] N81-12621
Argonne solar energy program. Summary of solar program activities
[ANL-80-80] N81-12622
Impact for the 80's: Proceedings of a Conference on Selected Technology for Business and Industry
[NASA-CP-2149] N81-12978
Energy overview N81-12979

ENERGY TRANSFER

A reinvestigation of transients in the cyclopropane system by the variable encounter method
[AD-A090168] N81-12228
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
Laser fusion studies at NRL
[AD-A090116] N81-12850

ENGINE CONTROL

Propulsion Controls, 1979 --- air breathing engine control
[NASA-CP-2137] N81-12090
Multivariable identification using centralized fixed modes N81-12091
Performance seeking controls N81-12092
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
Design of a multivariable integrated control for a supersonic propulsion system --- variable stream control engine N81-12094
Propulsion controls N81-12095
Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096
Should we attempt global (inlet engine airframe) control design? N81-12097
Road map to adaptive optimal control --- jet engine control N81-12098
Propulsion control and control theory: A new research focus N81-12099
Multivariable synthesis with transfer functions --- applications to gas turbine engines N81-12102
Alternatives for jet engine control N81-12103

ENGINE DESIGN

Road map to adaptive optimal control --- jet engine control N81-12098
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates
[NASA-CR-161608] N81-12161
Energy-environmental impacts of five energy conservation measures in the middle Atlantic and Pacific states
[BNL-51110] N81-12662

ENGINE FAILURE

Sensor/actuator failure detection for turbofan engines N81-12104

ENGINE INLETS
Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) — Lewis 9 by 15 foot low speed wind tunnel tests
[NASA-TP-1178] N81-12084
ENGINE MONITORING INSTRUMENTS
Synopsis on aircraft integrated data systems and engine health monitoring and maintenance
[DFVLR-MITT-80-08] N81-12063
Engine diagnostics program: CF6-50 engine performance deterioration
[NASA-CR-159867] N81-12085
Sensor/actuator failure detection for turbofan engines N81-12104
Current and future needs for engine electronic control sensors N81-12435
ENGINE PARTS
Metallurgical aspects of materials processing and manufacturing for aero-engine components — gas turbine engines
[PNR-90019] N81-12209
ENGINE TESTS
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994
Technical suppositions developed for smoke measurements during high pressure full annular combustor tests and engine trials N81-12995
ENGINEERING DRAWINGS
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054
ENGLISH CHANNEL
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
ENTHALPY
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168
ENVIRONMENT EFFECTS
Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216
Crack propagation and deformation in PZT transducer ceramics
[AD-A090569] N81-12234
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
Overall requirements for an advanced underground coal extraction system — environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
A strategic cost-benefit analysis of energy policies: Detailed projections
[BNL-51127] N81-12613
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655
Geothermal energy environmental problems and control methods: Review of recent findings
[DOE/ET-27224/T1] N81-12658
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660
Proceedings of the International Workshop of the Effects of acid precipitation vegetation, soils, and terrestrial ecosystems
[BNL-51195] N81-12661
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
ENVIRONMENT MANAGEMENT
Analysis of air quality management with emphasis on transportation sources
[NASA-CR-163746] N81-12647
ENVIRONMENT MODELS
Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696
ENVIRONMENT POLLUTION
Geothermal energy environmental problems and control methods: Review of recent findings
[DOE/ET-27224/T1] N81-12658
ENVIRONMENT PROTECTION
Clean air act-amendments of 1977: Oversight
[GPO-63-136] N81-12648
Proposed rulemaking on the storage and disposal of nuclear waste. Cross statement of the United States Department of Energy
[DOE/NE-0007-SUPPL-1] N81-12855
ENVIRONMENTAL ENGINEERING
Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286
ENVIRONMENTAL MONITORING
Remote sensing program activity report — Vermont
[E81-10015] N81-12492
In pursuit of clean air: A data book of problems and strategies at the state level. Volume 3: Federal regions 4 and 6
[ANL/EES-TM-90-VOL-3] N81-12656
ENVIRONMENTAL QUALITY
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
Report to the National Commission of Air Quality on the benefit methodology evaluation panel
[PB80-208390] N81-12668
ENVIRONMENTAL SURVEYS
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649
ENVIRONMENTAL TESTS
Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252
Testing program for determining the mechanical properties of concrete to temperatures of 621 C
[CONF-800969-1] N81-12459
EPIDEMIOLOGY
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707
EPITAXY
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564
Night vision devices. Citations from the NTIS data base
[PB80-814957] N81-12879
Epitaxial growth of CdSnP2 on InP for microwave FETs
[AD-A090285] N81-12913
EPOXY COMPOUNDS
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Bonding silicons with epoxies
[BDX-613-2432] N81-12240
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
EPOXY MATRIX COMPOSITE MATERIALS
Conveyorized radio frequency cure of epoxy glass composites
[AD-A089728] N81-12176
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Evaluation of filament-wound Kevlar-49/epoxy fatigue properties
[UCRL-15264] N81-12224
EPOXY RESINS
Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
Morphology and phase composition of an amine cured rubber modified epoxy
[SAND-80-1914C] N81-12242
EQUATIONS OF MOTION
Unsteady aerodynamics inputs for aeroelastic analyses. Part A: A general introduction. Part B: Prediction of the unsteady airloads on oscillating lifting systems and bodies in subsonic and supersonic flow
[DFVLR-MITT-80-01] N81-12035
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
EQUIPMENT SPECIFICATIONS
Rationalization of power subsystem design specifications for ESA spacecraft
[ESA-CR(P)-1348] N81-12163
EQUIVALENT CIRCUITS
Modeling of compressed magnetic field generators by equivalent circuit approach
[AWRE-O-21/80] N81-12351
ERBIUM COMPOUNDS
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
EROSION
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
Hot errosion of glass
[AD-A090312] N81-12231
ERROR ANALYSIS
Error analysis of pursuit and proportional navigation control laws
[AD-A090155] N81-12056
Field evaluation of the ANS-2000 land navigation system
[AD-A090793] N81-12061
Satellite pointing errors and their statistics
[ESS/SS-957] N81-12152
Developments in United Kingdom waveguide power standards
[RSRE-80006] N81-12319
Mass measurement with the electron microscope
[BNL-25536] N81-12400
ERROR CORRECTING CODES
POSER: A Process Organization to Simplify Error Recovery — fault tolerant real time computer systems
[RSRE-MEMO-3249] N81-12772
ERRORS
Noise measurements and the dB — errors
[RAE-TM-FS-348] N81-12827
ESA SATELLITES
Reliable software: Standards for the production of high quality systems — esa satellites
[ESA-CR(P)-1358] N81-12770
ESTIMATES
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
ESTIMATING
Energy-environmental impacts of five energy conservation measures in the middle Atlantic and Pacific states
[BNL-51110] N81-12662
ESTUARIES
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
ETCHANTS
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
ETCHING
Thin film corrosion
[BDX-613-2435] N81-12217
Physical and chemical processes for the generation of one micrometer structures
[BMFT-FB-T-79-51] N81-12291
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163806] N81-12549
ETHERS
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C — air breathing engines
[NASA-CR-159794] N81-12227

ETHYL ALCOHOL
Grain ethanol as a petroleum substitute: A perspective
[ANL/SPG-9] N81-12279
ETHYLENE
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
Polyketones and polysulfones for conservation in the ethylene polymer
[BNL-51155] N81-12237
EUROPEAN COMMUNICATIONS SATELLITE
Swedish space activities during 1979 N81-12125
Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471
EUROPEAN SPACE PROGRAMS
Swedish space activities during 1979 N81-12125
BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128
BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129
Proposals to use micro-accelerometers for space geodetic experiments
[ESA-CR(P)-1371] N81-12160
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537
Activities of the Space Science Department in 1978/1979
[ESA-SP-1032] N81-12992
EUTECTIC ALLOYS
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615
EUTROPHICATION
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
EVALUATION
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide --- aerospace materials
[ESA-STM-213] N81-12251
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594
A strategic cost-benefit analysis of energy policies: Detailed projections
[BNL-51127] N81-12613
Nonlinear chi-square algorithm: An improvement on nonlinear least squares
[AD-A090420] N81-12792
EVAPORATION
Evaporation by mechanical vapor recompression
[BSDF-38-3Q-80] N81-12195
EVAPORATORS
Open cycle OTEC system with falling jet evaporator and condenser
[SERI/TP-631-791] N81-12573
EVAPOTRANSPIRATION
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
EVOLUTION (DEVELOPMENT)
Significant achievements in the planetary geology program, 1980
[NASA-TM-82384] N81-12955
EXCIMER LASERS
Excimer potential curves
[AD-A090516] N81-12414
EXCIMERS
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
EXCITATION
Excimer potential curves
[AD-A090516] N81-12414
Electronic excitation in molecular collisions structural dynamic and kinetic considerations
[AD-A090287] N81-12833
Multiple ionization and excitation processes in single ion-atom collisions
[CONF-800859-1] N81-12838
Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915
EXHAUST EMISSION
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
USAF Aircraft Engine emission goals, a critical review
[AD-A090282] N81-12651
EXHAUST GASES
Effect of ambient conditions on the emissions from a gas turbine combustor
[NASA-CR-3355] N81-12105
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365
Technical suppositions developed for smoke measurements during high pressure full annular combustor tests and engine trials N81-12995
Studying the exhaust gas from a post combustion turbojet engine N81-12996
EXHAUST NOZZLES
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825
EXISTENCE THEOREMS
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778
EXOBIOLOGY
Aerospace Medicine and Biology: A continuing bibliography with indexes, supplement 211, October 1980
[NASA-SP-7011(211)] N81-12723
EXOTHERMIC REACTIONS
Report on explosives machining
[AD-A090732] N81-12259
EXPERIMENTAL DESIGN
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report N81-12709
Study of the operational deployment of SIRIO-2 ground stations, volume 3 --- meteorological data distribution
[ESA-CR(P)-1369-VOL-3] N81-12713
EXPERIMENTATION
Experiments on the effect of ultraviolet on contamination in vacuum systems
[NASA-TM-81999] N81-12976
EXPLOSIVE DEVICES
Modeling of compressed magnetic field generators by equivalent circuit approach
[AWRE-O-21/80] N81-12351
EXPLOSIVES
Active control of an explosive wing-store flutter case --- Langley Research Center N81-12117
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257
Report on explosives machining
[AD-A090732] N81-12259
Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263
A reaction mechanism in the shock initiation of detonation: A theoretical study
[AD-A090357] N81-12264
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
EXPOSURE
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
EXTARS
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
EXTERNAL STORES
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115
Wind tunnel tests on a fighter aircraft wing/store flutter suppression system: The B.Ae control law N81-12119
EXTINGUISHING
Development of a new polyurea foam insulation material
[EUR-6737-EN] N81-12235
EXTRATERRESTRIAL RESOURCES
The Moon treaty
[GPO-88-705] N81-12937
Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-88-636] N81-12939
EXTRUDING
Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233

F

FABRICATION
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
Heat resistant plastics: Silicone, carborane, halocarbon, and other polymers. Citations from the NTIS data base
[PB80-814734] N81-12253
Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554
Automated linear concentrator cell module assembly
[SAND-80-7103] N81-12610
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914
FABRICS
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
FAILURE ANALYSIS
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425
On the decision to replace a unit early or late: A graphical solution
[SAAB-FTK-0-79-19] N81-12438
Failure detection system design methodology
[NASA-CR-163792] N81-12439
Fractography: A survey
[NLR-MP-77026-U] N81-12473
High-performance batteries for electric-vehicle propulsion and stationary energy storage
[ANL-79-94] N81-12614
FAILURE MODES
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427

FAN BLADES
Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2
[NASA-CR-159879] N81-12087
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
FAR INFRARED RADIATION
Design studies for a far infrared absolute spectrometer for the cosmic background explorer
[NASA-CR-160051] N81-12385
FAR ULTRAVIOLET RADIATION
Observation of the solar ultraviolet radiation
[AERONOMICA-ACTA-A-211-1980] N81-12972
FARM CROPS
Sorghums as energy crops
[CONF-800482-5] N81-12534
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
FARMLANDS
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
FAST FOURIER TRANSFORMATIONS
SWIFT
[AD-A090647] N81-12343
FATIGUE (BIOLOGY)
Evaluation of Army aviator human factors, fatigue, in a high threat environment
[AD-A090751] N81-12730
FATIGUE (MATERIALS)
Fatigue crack propagation and corrosion fatigue of AF 1410 steel
[AD-A090497] N81-12453
Fractography: A survey
[NLR-MP-77026-U] N81-12473
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
The use of ion implantation for materials processing
[AD-A090714] N81-12903
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920
FATIGUE LIFE
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449
Application of fracture mechanics to US Air Force aircraft structural integrity requirements
[AAAF-NT-79-25] N81-12463
Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464
FATIGUE TESTS
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Effect of various surface protections on the stress corrosion behavior of light alloys --- aluminum alloys
[SNIAS-801-551-102] N81-12220
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440
A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462
Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464
Manual for the AGARD-coordinated Corrosion Fatigue Cooperative Testing Program (CFCTP)
[NLR-MP-79017-U] N81-12474
FEASIBILITY ANALYSIS
Aircraft towing feasibility study
[DOE/CS-50069/1] N81-12051
IRIS derived rocket (IDR) to be used as Ariane 4th stage
[ESA-CR(P)-1370] N81-12166
Heat recovery devices, new
[PB80-205438] N81-12384
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
FEDERAL BUDGETS
NASA authorization, 1982 (program review), volume 1
[GPO-68-972] N81-12938
FEEDBACK
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
FEEDBACK CONTROL
Closed loop control systems: Aircraft. Citations from the NTIS data base
[PB80-813710] N81-12114
Current and future needs for engine electronic control sensors N81-12435
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783
FERROELECTRICITY
Microstructure and domain structure of PZT --- piezoelectric materials
[LBL-10651] N81-12917
FERTILIZERS
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
FIBER COMPOSITES
Evaluation of filament-wound Kevlar-49/epoxy fatigue properties
[UCRL-15264] N81-12224
FIBER OPTICS
Light communications Systems. Citations from the NTIS data base
[PB80-815301] N81-12321
Laser research and applications
[GPO-66-074] N81-12406
Room temperature, CW, single mode laser
[AD-A090326] N81-12410
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
Fiber optic combiner and duplicator
[NASA-CR-160044] N81-12864
Nuclear radiation effects in fiber-optic waveguides
[AD-A090439] N81-12868
FIBER ORIENTATION
Maximizing the intersection density of fiber processes
[CTH-MATH-1980-4] N81-12185
FIBER REINFORCED COMPOSITES
Laminates and reinforced metals
[NASA-TM-81591] N81-12171
Conveyorized radio frequency cure of epoxy glass composites
[AD-A089728] N81-12176
Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455
FIBERS
Optical fibers and avalanche photodiodes for scintillator counters
[BNL-28195] N81-12876
FIELD EFFECT TRANSISTORS
A study of trends and techniques for space base electronics
[NASA-CR-161277] N81-12327
Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333
Epitaxial growth of CdSnP2 on InP for microwave FETs
[AD-A090285] N81-12913
FIELD EMISSION
Field emission electric propulsion. Development and manufacturing of a positive pressure tank
[ESA-CR(P)-1365] N81-12165
FIELD THEORY (PHYSICS)
Looking for heavier weak bosons with DUMAND
[NASA-TM-82027] N81-12828
FIGHTER AIRCRAFT
Experimental and numerical study of flow in air intakes at high incidences
[AAAF-NT-80-19] N81-12031
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort N81-12116
Test and analyses of an active flutter suppression system on an FFDL model of YF17 N81-12118
Wind tunnel tests on a fighter aircraft wing/store flutter suppression system: The B.Ae control law N81-12119
Are management problems in the acquisition of aircraft gas turbine engines being corrected
[AD-A090520] N81-12928
FILAMENT WINDING
Evaluation of filament-wound Kevlar-49/epoxy fatigue properties
[UCRL-15264] N81-12224
FILE MAINTENANCE (COMPUTERS)
Comparison of and conversion between different implementations of the FORTRAN programming language
[NASA-TM-81995] N81-12762
A scientific data base for the Royal Aircraft Establishment, Farnborough, England
[RAE-TR-80048] N81-12932
FILM COOLING
Curved film cooling admission tube
[NASA-CASE-LEW-13174-1] N81-12363
Heat transfer rate and film cooling effectiveness measurements in a transient cascade N81-13000
FINITE DIFFERENCE THEORY
A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018
FINITE ELEMENT METHOD
Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071
Three dimensional finite element combustion instability analysis
[AD-A090396] N81-12194
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455
GRID and CQUAD: Two preprocessing codes for NASTRAN
[AD-A090664] N81-12460
Lagrangian three-dimensional finite-element formulation for the nonlinear fluid-structural response of reactor components
[ANL-80-26] N81-12461
The use of the finite element method in meteorological modelling
[AD-A090761] N81-12700
Finite element analysis of a dynamically loaded flat laminated plate
[AD-A089985] N81-12787
Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801
Finite element analysis of crack growth
[NLR-MP-78017-U] N81-12802
FINLAND
Space activities in Finland in 1979 N81-12126
FIRE CONTROL
SLBM fire control computational algorithms in support of stellar inertial guidance
[AD-A090650] N81-12057
Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060
Frequency diverse tracking/guidance millimeter radar adapted to target acquisition
[AD-A090355] N81-12305

FIRE DAMAGE
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
FIRE EXTINGUISHERS
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189
FLAME PROPAGATION
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
FLAME SPECTROSCOPY
Diagnosing combustion by D.R.A.S.C. --- coherent anti-Stokes Raman spectroscopy N81-13009
FLAME TEMPERATURE
Flame temperature profiles obtained by the two-line atomic fluorescence method N81-13012
FLAMMABILITY
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189
Flammability testing --- aerospace materials
[ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
FLAT PLATES
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
GRID and CQUAD: Two preprocessing codes for NASTRAN
[AD-A090664] N81-12460
Flat plate solar collector design and performance. Citations from the Engineering Index data base
[PB80-814122] N81-12638
Flat plate solar collector design and performance. Citations from the NTIS data base
[PB80-814130] N81-12639
FLEXIBILITY
Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468
FLEXING
The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470
FLIGHT CHARACTERISTICS
Synthesis of test results obtained with Concorde at high incidences
[AAAF-NT-80-26] N81-12079
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113
FLIGHT CONTROL
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide
[NASA-CR-152306] N81-12110
Closed loop control systems: Aircraft. Citations from the NTIS data base
[PB80-813710] N81-12114
FLIGHT HAZARDS
Aviation safety
[GPO-68-717] N81-12040
Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mohawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044
FLIGHT OPTIMIZATION
Some aspects on improvements of a first-order dynamic optimization algorithm
[SAAB-TN-AE-73] N81-12769
FLIGHT PATHS
Experimental and numerical study of flow in air intakes at high incidences
[AAAF-NT-80-19] N81-12031
Synthesis of test results obtained with Concorde at high incidences
[AAAF-NT-80-26] N81-12079
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
FLIGHT PLANS
IFR aircraft handled forecast by air route traffic control center, fiscal years 1980-1991
[AD-A090803] N81-12048
FLIGHT SIMULATION
Experiments on an airfoil at high incidence in plunging motion
[AAAF-NT-80-09] N81-12030
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043
A mathematical model of the CH-53 helicopter
[NASA-TM-81238] N81-12065
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
Peripheral cues and color in visual simulation
[AD-A089837] N81-12726
FLIGHT STABILITY TESTS
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Some new research approaches to aircraft spin studies
[AAAF-NT-80-12] N81-12112
FLIGHT STRESS (BIOLOGY)
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727
FLIGHT TESTS
Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068
Flight test handbook: Flying qualities theory and flight test techniques
[AD-AC90525] N81-12073
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
FLIGHT TRAINING
Flight test handbook: Flying qualities theory and flight test techniques
[AD-A090525] N81-12073
FLOW CHARACTERISTICS
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
Analytical investigation of critical phenomena in MHD power generators
[NASA-CR-165143] N81-12546
FLOW DISTRIBUTION
Effects of boundary-layer treatment on cryogenic wind-tunnel controls
[NASA-CR-159372] N81-12120
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
FLOW EQUATIONS
Transonic flow computations with separate treatment of the subsonic and supersonic regions
[AD-A090327] N81-12025
FLOW GEOMETRY
Theoretical regime diagrams for thermally driven flows in a beta-plane channel in the presence of variable gravity
[NASA-TM-78316] N81-12676
FLOW MEASUREMENT
Measurements in a two dimensional wake merging into a boundary layer
[NLR-TR-79063-U] N81-12034
Principle of laser Doppler velocimeter measurements in a fully transparent pump
[VKI-PREPRINT-1979-12] N81-12375
Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993
Velocity and turbulence measurements in turbulent flames using the L2F technique N81-13003
FLOW STABILITY
Low drag airfoil design utilizing passive laminar flow and coupled diffusion control techniques
[AD-A090778] N81-12024
Laser like approach to the dynamics of convective instabilities
[CISE-1533] N81-12371
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825
FLOW VELOCITY
Effect of hole geometry and Electric-Discharge Machining (EDM) on airflow rates through small diameter holes in turbine blade material
[NASA-TP-1716] N81-12089
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360
Two-phase critical flow of saturated and subcooled liquids through valves
[ANL/RAS/LWR-79-7] N81-12370
Effects of xenon cover gas in CO2 laser welding
[BDX-613-2442] N81-12430
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005
A method for the measurements of mixing properties in a flow N81-13015
FLOW VISUALIZATION
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
Experiments on an airfoil at high incidence in plunging motion
[AAAF-NT-80-09] N81-12030
Boundary layer measurements on a two dimensional wing with flap and a comparison with calculations
[NLR-MP-79034-U] N81-12036
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
The use of optical techniques in the interpretation of heat transfer measurements N81-13007
FLUID DYNAMICS
A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364
Nonlinear magnetohydrodynamics
[ORO-5260-4] N81-12896
Heat transfer rate and film cooling effectiveness measurements in a transient cascade N81-13000
FLUID FLOW
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390
FLUID MECHANICS
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
FLUIDIZED BED PROCESSORS
Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203
Sampling and analysis of hydrocarbons in combustion gases
[ANL/CEN/FE-80-11] N81-12204
Support studies in fluidized-bed combustion
[ANL/CEN/FE-79-14] N81-12280
FLUORESCENCE
Flame temperature profiles obtained by the two-line atomic fluorescence method N81-13012
FLUORIDES
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660
FLUSHING
Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188

FLUTTER ANALYSIS
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort
N81-12116
Test and analyses of an active flutter suppression system on an FFDL model of YF17 N81-12118
FLUX DENSITY
Research, development and demonstration of lead-acid batteries for electric vehicle propulsion
[ANL/OEPM-79-7] N81-12954
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
FLYWHEELS
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427
FOAMS
Phenolic resin syntactic foams
[BDX-613-2408] N81-12244
FOCI
The 1976 earthquake sequence in Uzbekistan: Focal mechanisms determined using the relative amplitude method
[AWRE-O-27/80] N81-12692
FOG
Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411
FOG DISPERSAL
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715
FORCE DISTRIBUTION
Evaluation of Levinsky's method for the calculation of the lift distribution on a wing in propulsive jets
[NLR-TR-77104-U] N81-12033
FORECASTING
IFR aircraft handled forecast by air route traffic control center, fiscal years 1980-1991
[AD-A090803] N81-12048
FOREST FIRES
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
FOREST MANAGEMENT
Forest resource information system --- St. Regis Paper Co.
[E81-10004] N81-12481
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492
Energy research and extension
[GPO-61-544] N81-12562
FORESTS
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519
FORMAT
A cartographic computer data format and associated programs --- for image processing
[RAE-TR-80037] N81-12539
FORMING TECHNIQUES
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221
FORMULATIONS
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
FORTRAN
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
Comparison of and conversion between different implementations of the FORTRAN programming language
[NASA-TM-81995] N81-12762
FOURIER TRANSFORMATION
DFT decomposition and implementation for concurrent execution on multiple processing elements
[AD-A090725] N81-12748
Efficient multipliers for the FFT
[AD-A090648] N81-12789
FRACTOGRAPHY
Fractography: A survey
[NLR-MP-77026-U] N81-12473
FRACTURE MECHANICS
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457
Application of fracture mechanics to US Air Force aircraft structural integrity requirements
[AAAF-NT-79-25] N81-12463
Experimental methodology. Application of concepts from mechanics to material rupture studies
[SNIAS-801-551-104] N81-12466
Green's function in fracture mechanics
[RAE-TR-80035] N81-12469
Application of fracture mechanics to built-up structures --- aircraft handbooks
[NLR-MP-79044-U] N81-12475
Finite element analysis of crack growth
[NLR-MP-78017-U] N81-12802
FRACTURES (MATERIALS)
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457
FRAGMENTATION
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425
FRANCE
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
FREE ELECTRON LASERS
Three dimensional non-linear theory of the free electron laser
[AD-A090321] N81-12409
Laser satellite power systems
[ANL/ES-92] N81-12592
FREE ELECTRONS
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
FREE ENERGY
Effects of several trace contaminants on fuel cell performance
[DOE/METC-RI-80-17] N81-12591
FREE FLIGHT
Optimal estimation of missile free-flight trajectory: Comparative results of linear and nonlinear Kalman filter approaches
[AD-A090717] N81-12144
FREE JETS
Correlation measurement of velocity and temperature fluctuations in a free jet diffusion flame
N81-13002
FRENCH SPACE PROGRAMS
French space programs for 1979 N81-12127
FREQUENCY CONTROL
Investigation into the sensitive parameters in a quartz oscillator
[ESA-TT-636] N81-12352
FREQUENCY DIVISION MULTIPLEXING
Wideband multiplex system
[AD-A090770] N81-12312
FREQUENCY SCANNING
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
FREQUENCY SHIFT
Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields
[AD-A090361] N81-12332
FRESNEL LENSES
X-ray holography with X-rays
[AD-A090807] N81-12393
FRESNEL REGION
X-ray holography with X-rays
[AD-A090807] N81-12393
FRETTING
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
FRICTION
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257
FUEL CELLS
Effects of several trace contaminants on fuel cell performance
[DOE/METC-RI-80-17] N81-12591
Fuel cells. Citations from the NTIS data base
[PB80-813397] N81-12640
Fuel cells. Citations from the NTIS data base
[PB80-813389] N81-12641
FUEL COMBUSTION
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197
FUEL CONSUMPTION
Aircraft towing feasibility study
[DOE/CS-50069/1] N81-12051
Energy use in office buildings. Volume 1: Analysis of 1977 office building energy use as reported in the Building Owners and Managers Association Data Base
[DOE/CS-20189/1] N81-12593
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600
FUEL OILS
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
FUEL PRODUCTION
Alternative transportation fuels
[CONF-800419-5] N81-12267
Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271
Grain ethanol as a petroleum substitute: A perspective
[ANL/SPG-9] N81-12279
FUEL TANK PRESSURIZATION
Field emission electric propulsion. Development and manufacturing of a positive pressure tank
[ESA-CR(P)-1365] N81-12165
FUEL TANKS
Field emission electric propulsion. Development and manufacturing of a positive pressure tank
[ESA-CR(P)-1365] N81-12165
FUEL TESTS
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
FUNCTIONAL ANALYSIS
A comparative analysis of functional correctness
[AD-A090487] N81-12767
FUNCTIONS (MATHEMATICS)
On the smoothness of Markov chain transition functions
[CTH-MATH-1980-5] N81-12810

FURFURYL ALCOHOL
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170
FUSION REACTORS
The magnetic fusion energy program: Its objectives and pace
[GPO-58-764] N81-12849
A reactor study on a belt-shaped screw pinch --- configuration
[REPT-73-76] N81-12902

G

GALACTIC CLUSTERS
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958
GALACTIC STRUCTURE
Search for faint galactic features --- digital image processing
[LA-UR-80-2357] N81-12960
GALILEO PROJECT
Space shuttle and Galileo mission
[GPO-53-938] N81-12940
GALLIUM
Excimer potential curves
[AD-A090516] N81-12414
GALLIUM ARSENIDES
Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564
High efficiency GaAs-GaAlAs solar cells for very high concentration systems
[CISE-1517] N81-12630
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914
GAMMA RAY OBSERVATORY
Future prospects for gamma-ray
[NASA-TM-82041] N81-12959
GAMMA RAY SPECTRA
Pulsar gamma-rays: Spectra luminosities and efficiencies
[NASA-TM-82026] N81-12962
GAMMA RAY TELESCOPES
Future prospects for gamma-ray
[NASA-TM-82041] N81-12959
GAS ANALYSIS
Studying the exhaust gas from a post combustion turbojet engine N81-12996
GAS COMPOSITION
The application of UV spectroscopy to the qualtitative analysis of nitrogen oxide N81-13008
GAS COOLING
High temperature gas-insulated systems
[EPRI-EL-1500] N81-12368
GAS GENERATORS
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164
GAS HEATING
High temperature gas-insulated systems
[EPRI-EL-1500] N81-12368
GAS LASERS
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
GAS TRANSPORT
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883
GAS TURBINE ENGINES
Engine diagnostics program: CF6-50 engine performance deterioration
[NASA-CR-159867] N81-12085
Effect of hole geometry and Electric-Discharge Machining (EDM) on airflow rates through small diameter holes in turbine blade material
[NASA-TP-1716] N81-12089
Effect of ambient conditions on the emissions from a gas turbine combustor
[NASA-CR-3355] N81-12105
Metallurgical aspects of materials processing and manufacturing for aero-engine components --- gas turbine engines
[PNR-90019] N81-12209
An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783
A comparison of the three methods used to obtain acoustic measurements for the NASA Flight Effects Program
[NASA-TM-81906] N81-12822
Progress in materials and structures at Lewis Research Center N81-12982
GAS TURBINES
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
Advanced industrial gas turbine techology readiness demonstration
[DOE/OR-05035/T1] N81-12426
The constant volume process in relation to the gas turbine as exemplified by the Karavodine engine
[WTHD-118] N81-12434
GAS WELDING
Inert gas welding. Citations from the Engineering Index data base
[PB80-815228] N81-12436
Inert gas welding. Citations from the NTIS data base
[PB80-815210] N81-12437
GAS-SOLID INTERFACES
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873
GASOHOL (FUEL)
Alternative transportation fuels
[CONF-800419-5] N81-12267
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
Grain ethanol as a petroleum substitute: A perspective
[ANL/SPG-9] N81-12279
Sorghums as energy crops
[CONF-800482-5] N81-12534
GASOLINE
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
GATES (CIRCUITS)
The MSFC silicon gate silicon-on-sapphire standard cell library
[NASA-TM-78194] N81-12324
GAUSS EQUATION
Equivalent Gaussian measures whose R-N derivative is the exponential of a diagonal form
[AD-A090787] N81-12807
GEARS
The investigation into hydraulic gear pump efficiencies in the first few hours of the pumps' lives and a comparative study of accelerated life tests methods on hydraulic fluid power gear pumps, part 3
[AD-A089848] N81-12423
GEHLENITE
Czochralski growth of single-crystal gehlenite $Ca_2Al_2SiO_7$
[CONF-800908-2] N81-12921
GENERAL AVIATION AIRCRAFT
Low-speed aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications
[NASA-TP-1498] N81-12015
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
GENETICS
Clines in the presence of asymmetric migration
[MC-TW-200/80] N81-12811
GEODESY
Reference coordinate systems for Earth dynamics: A preview
[NASA-CR-163800] N81-12525
GEODETIC COORDINATES
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection
[NASA-TM-81998] N81-12528
GEODETIC SATELLITES
Proposals to use micro-accelerometers for space geodetic experiments
[ESA-CR(P)-1371] N81-12160
GEOGRAPHY
Minimum variance geographic sampling
[E81-10033] N81-12515
GEOIDS
Accuracy of the determination of mean anomalies and mean geoid undulations from a satellite gravity field mapping mission
[REPT-307] N81-12669
GEOLOGY
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
GEOMAGNETISM
Studies related to Magsat
[E81-10016] N81-12493
Equivalent source modeling of the main field using Magsat data
[E81-10026] N81-12503
Magsat vector magnetometer calibration using Magsat geomagnetic field measurements
[NASA-TM-82046] N81-12527
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687
GEOPOTENTIAL
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
GEORGIA
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
GEOS SATELLITES (ESA)
Development of a fold-out rigid solar array for three axis-stabilized geosynchronous satellites
[SNIAS-801-440-101] N81-12150
GEOTHERMAL ENERGY CONVERSION
Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655
Geothermal energy environmental problems and control methods: Review of recent findings
[DOE/ET-27224/T1] N81-12658
GEOTHERMAL RESOURCES
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4
[DOE/RG-10075/T1] N81-12269
Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655
Geothermal energy environmental problems and control methods: Review of recent findings
[DOE/ET-27224/T1] N81-12658
GERMANY
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
GERT
On the decision to replace a unit early or late: A graphical solution
[SAAB-FTK-0-79-19] N81-12438
GIRDERS
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283

GLASS
Hot errosion of glass
[AD-A090312] N81-12231
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232
GLASS FIBER REINFORCED PLASTICS
Contact law and impact responses of laminated composites
[NASA-CR-150884] N81-12172
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
GLASS FIBERS
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
GLOBAL ATMOSPHERIC RESEARCH PROGRAM
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program
N81-12708
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report
N81-12709
The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A --- monsoon experiment N81-12710
GLOW DISCHARGES
Passivation of GaAs surfaces
[AD-A090512] N81-12909
GLYCOLS
Study of aluminum corrosion in aluminum solar heat collectors using aqueous glycol solution for heat transfer
[DOE/CS-3107/T2] N81-12215
GOES SATELLITES
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675
GOLD
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
Thin film corrosion
[BDX-613-2435] N81-12217
GOLD COATINGS
The improvement of external lead bond and flexure strengths by comparing lead base materials
[BDX-613-2339] N81-12219
GOVERNMENT/INDUSTRY RELATIONS
Priority energy project act of 1979
[GPO-58-154] N81-12555
GOVERNMENTS
The foundations of United States information policy
[PB80-204019] N81-12933
GRAIN BOUNDARIES
Thickening of a shock front by the grain structure of a solid
[LA-8410-MS] N81-12369
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells
[DOE/ET-23108/4] N81-12601
Characterization of internal boundary layer capacitors
[DOE/ER-01198/1311] N81-12916
Simulation of the structure of vacancies in high angle grain boundaries
[COO-5002-10] N81-12919
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920
GRAINS
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
GRAINS (FOOD)
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
GRAPH THEORY
Graph theory leads to program visibility --- computer program integrity
[RSRE-80004] N81-12771
GRAPHITE-EPOXY COMPOSITE MATERIALS
Sonic fatigue design techniques for advanced composites aircraft structures
[AD-A090553] N81-12069
Contact law and impact responses of laminated composites
[NASA-CR-159884] N81-12172
GRAPHITE-POLYIMIDE COMPOSITES
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
GRAPHS (CHARTS)
A modified T-value method for selection of strain gages for measuring loads on a low aspect ratio wing
[NASA-TP-1748] N81-12066
Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12647
GRAVIMETRY
Accuracy of the determination of mean anomalies and mean geoid undulations from a satellite gravity field mapping mission
[REPT-307] N81-12669
GRAVITATION
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687
GRAVITATIONAL EFFECTS
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123
GRAVITATIONAL FIELDS
Accuracy of the determination of mean anomalies and mean geoid undulations from a satellite gravity field mapping mission
[REPT-307] N81-12669
GRAVITY ANOMALIES
Accuracy of the determination of mean anomalies and mean geoid undulations from a satellite gravity field mapping mission
[REPT-307] N81-12669
GRAVITY WAVES
Theoretical regime diagrams for thermally driven flows in a beta-plane channel in the presence of variable gravity
[NASA-TM-78316] N81-12676
GREAT PLAINS CORRIDOR (NORTH AMERICA)
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Stratum variance estimation for sample allocation in crop surveys --- Great Plains Corridor
[E81-10035] N81-12517
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-81-316] N81-12649
GREEN FUNCTION
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
Green's function in fracture mechanics
[RAE-TR-80035] N81-12469
GRINDING (COMMINUTION)
Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271
GROUND EFFECT MACHINES
Surface effect vehicle/ships in Marine environments. Citations from the NTIS data base
[PB80-814528] N81-12293
Surface effect vehicles and surface effect: General studies. Citations from the NTIS data base
[PB80-814551] N81-12294
Surface effect vehicles/ships in Marine environments. Citations from the Engineering Index data base
[PB80-814510] N81-12295
GROUND STATE
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
GROUND STATIONS
Technical regulations: Hydrology and international hydroiogical codes
[WMO-555] N81-12540
Study of the operational deployment of SIRIO-2 ground stations. Volume 1 --- meteorological data traffic
[ESA-CR(P)-1369-VOL-1] N81-12711
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
Study of the operational deployment of SIRIO-2 ground stations, volume 3 --- meteorological data distribution
[ESA-CR(P)-1369-VOL-3] N81-12713
GROUND TRACKS
Test track facilities --- military vehicles
[MVEE-MEMO-79021] N81-12122
GROUND WAVE PROPAGATION
Effects of ionospheric reflection height and ground conductivity on earth-ionosphere waveguide mode and ground-wave attenuation rates
[AD-A090716] N81-12686
GROUP THEORY
A historically motivated study of families of Pythagorean or Babylonian triples and their generating semigroups of p- or b-orthonormal matrices
[CTH-MATH-1980-3] N81-12815
GUIDANCE (MOTION)
Field evaluation of the ANS-2000 land navigation system
[AD-A090793] N81-12061
GULF STREAM
The dynamics of oceanic fronts. Part 1: The Gulf Stream
[NASA-TM-80335-PT-1] N81-12717
The Gulf Stream. Citations from the NTIS data base
[PB80-814098] N81-12718
GUN PROPELLANTS
Burning rate transitions for HMX burned as a binderless propellant
[AD-A090389] N81-12258
GUST LOADS
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
GYROCOMPASSES
Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060
Field evaluation of the ANS-2000 land navigation system
[AD-A090793] N81-12061
GYROSCOPES
Ring laser gyro
[AD-A090643] N81-12395

H

H-53 HELICOPTER
A mathematical model of the CH-53 helicopter
[NASA-TM-81238] N81-12065
HADRONS
Diffractive hadron dissociation at 100 and 200 GeV
[DOE/ER-02232/89] N81-12837
HALL EFFECT
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
HAMILTONIAN FUNCTIONS
Maxwell-Vlasov equations as a continuous Hamiltonian system
[PPPL-1702] N81-12797
HANGARS
A comparison between electric field strengths similarly generated and measured in the open air, in a shielded enclosure and in a large aircraft hangar, over frequency range 10 to 110 MHz
[RSRE-MEMO-3248] N81-12353
HARDNESS TESTS
Axial compression testing of vacuum tube glass ceramic/molybdenum frames
[GEPP-TIS-503] N81-12238
HARMONIC ANALYSIS
Electromagnetic waves scattering by buried dielectric objects
[AD-A090582] N81-12308
HARMONIC EXCITATION
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679

HARMONIC GENERATIONS
Second harmonic generation of near millimeter wave radiation by nonlinear bulk material
[AD-A090351] N81-12906
HARMONIC GENERATORS
Second harmonic generation of near millimeter wave radiation by nonlinear bulk material
[AD-A090351] N81-12906
HARMONICS
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
HARTMANN NUMBER
Effect of wetting layer and void fraction nonuniformity on the characteristics of a two-phase liquid-metal MHD generator
[LOG-E379] N81-12881
HAZARDS
Report on explosives machining
[AD-A090732] N81-12259
High-voltage spark carbon-fiber sticky-tape data analyzer
[NASA-CR-163747] N81-12646
HAZE DETECTION
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715
HEAD (ANATOMY)
SPH-4 helmet damage and head injury correlation
[AD-A090750] N81-12740
On parachutist dynamics
[AD-A090335] N81-12741
HEALTH PHYSICS
Overall requirements for an advanced underground coal extraction system --- environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523
HEAO 2
An X-ray survey of nine historical novae --- HEAO 2 observations
[NASA-TM-82014] N81-12961
HEARING
Some further thoughts on temporary threshold shift --- hearing and intermittent noise
[RAE-TM-FS-338] N81-12734
HEAT BALANCE
Effect of environmental fluctuations on global energy balance of the Earth-atmosphere system
[AERONOMICA-ACTA-A-206-1979] N81-12670
Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696
HEAT BUDGET
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703
HEAT CAPACITY MAPPING MISSION
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission) --- Yerington, Nevada mine area
[E81-10018] N81-12495
Heat Capacity Mapping Mission (HCMM)
[E81-10020] N81-12497
Heat Capacity Mapping Mission (HCMM)
[E81-10021] N81-12498
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
HEAT EXCHANGERS
Heat recovery devices, new
[PB80-205438] N81-12384
Development of nondestructive evaluation techniques for high-temperature ceramic heat exchanger components
[ANL/MSD/FE-80-4] N81-12617
HEAT FLUX
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994
HEAT PIPES
Heat pipe honeycomb panel
[NASA-CASE-LAR-12637-1] N81-12362
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380
HEAT RESISTANT ALLOYS
Metallurgical aspects of materials processing and manufacturing for aero-engine components --- gas turbine engines
[PNR-90019] N81-12209
Correlation of the high-temperature corrosion behavior of structural alloys in coal conversion environments with the components of the alloys and of the corrosive environments
[BMI-2059] N81-12213
HEAT SOURCES
Experimental and theoretical study of thermal performance of a hybrid solar system at Living History Farms
[DOE/CS-34136/1] N81-12606
HEAT STORAGE
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
Development of a low-cost solar panel using laminated polymer films
[ALO-4121-2] N81-12577
Preliminary designs: Passive solar manufactured housing
[DOE/CS-30377/1] N81-12583
HEAT TRANSFER
High temperature gas-insulated systems
[EPRI-EL-1500] N81-12368
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
Flat plate solar collector design and performance. Citations from the NTIS data base
[PB80-814130] N81-12639
Determination of coefficients for the universal laws of friction and heat transfer for CFTL calculations --- reactor core flow
[ORNL/TM-7418] N81-12819
Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993
Heat transfer measurements related to hot turbine components in the von Karman Institute hot cascade tunnel N81-12999
Heat transfer rate and film cooling effectiveness measurements in a transient cascade N81-13000
HEAT TRANSFER COEFFICIENTS
In-flight boundary-layer measurements on a hollow cylinder at a Mach number of 3.0
[NASA-TP-1764] N81-12361
Application of model laws when determining the heat transfer coefficients by experiments on cooled turbine blades N81-12998
Studies of turbulence characteristics and their effects upon the distribution of heat transfer to turbine blading N81-13001
HEAT TREATMENT
Hot errosion of glass
[AD-A090312] N81-12231
HEATING
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
HEATING EQUIPMENT
Heat recovery devices, new
[PB80-205438] N81-12384
HEAVING
Wave power extraction from a transient heaving cylinder
[DOE/ET-21019/T1] N81-12599
HEAVY IONS
Multiple ionization and excitation processes in single ion-atom collisions
[CONF-800859-1] N81-12838
Studies of heavy ion reactions and transuranic nuclei
[COO-3496-75] N81-12841
HEAVY LIFT LAUNCH VEHICLES
Solar power satellites. A review of the space transportation options
[RAE-TR-80034] N81-12153
An assessment of the atmospheric effects of a satellite power system
[CONF-791204-39] N81-12705
HEAVY NUCLEI
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853
HELICOPTER CONTROL
LR-80 flight test report --- attitude and heading reference system
[AD-A090284] N81-12058
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide
[NASA-CR-152306] N81-12110
Mathematical models of pilot-helicopter systems
[NLR-MP-79026-U] N81-12742
HELICOPTER DESIGN
Impact of modern materials on the development of rotating airfoil equipment
[AAAF-NT-79-43] N81-12182
HELICOPTER PERFORMANCE
Aircraft accident report: New York Airways, Inc., Sikorsky S61-L, N618PA Newark, New Jersey, April 18, 1979
[NTSB-AAR-79-14] N81-12045
Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071
HELICOPTERS
Army GPS-doppler hybrid navigation system
[AD-A090394] N81-12062
Status of improved autorotative landing capability research
[AD-A090431] N81-12072
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074
Advanced transmission components investigation program: Bearing and seal development
[AD-A090675] N81-12075
HELIOSTATS
Open-loop heliostat reflector
[UCID-18764] N81-12587
Heliostat mirror survey and analysis
[PNL-3194] N81-12609
Solar energy concentrator design and operation. Citations from the Engineering Index data base
[PB80-813934] N81-12642
HELIUM-NEON LASERS
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877
HELMETS
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
SPH-4 helmet damage and head injury correlation
[AD-A090750] N81-12740
HELMHOLTZ VORTICITY EQUATION
Solving the Helmholtz equation for exterior problems with variables index of refraction, 1
[AD-A090550] N81-12309
HERMITIAN POLYNOMIAL
Compact numerical method for the simulation of separated viscous flow, stationary or not. Application
[AAAF-NT-80-04] N81-12374
HET EXPERIMENT
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967 - 1980 reference book, volume 1
[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136

Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137

HETEROJUNCTIONS
Room temperature, CW, single mode laser
[AD-A090326] N81-12410

HEURISTIC METHODS
An integrated methodology and tools for software development
[AD-A090347] N81-12766

HEXENES
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189

HIGH ENERGY INTERACTIONS
Search for direct photon production at Fermilab energies and comparison with direct photon measurements at IRS energies
[FERMILAB-CONF-79/85-EXP] N81-12843

HIGH FREQUENCIES
A computer based ionospheric sounding and HF noise measuring system
[ERL-0146-TR] N81-12299
Adaptive HF propagation path utilization
[AD-A090023] N81-12301

HIGH GAIN
Laser fusion studies at NRL
[AD-A090116] N81-12850

HIGH TEMPERATURE
Correlation of the high-temperature corrosion behavior of structural alloys in coal conversion environments with the components of the alloys and of the corrosive environments
[BMI-2059] N81-12213
Progress toward analytical description of the creep strain-time behavior engineering alloys
[CONF-800907-2] N81-12214
Hot errosion of glass
[AD-A090312] N81-12231

HIGH TEMPERATURE ENVIRONMENTS
Pressure vessels for coal liquefaction: An overview
[IS-M-282] N81-12429
Insulation development for high-temperature batteries for electric vehicle application
[CONS-5160-T1] N81-12571
Development of nondestructive evaluation techniques for high-temperature ceramic heat exchanger components
[ANL/MSD/FE-80-4] N81-12617

HIGH TEMPERATURE GASES
Curved film cooling admission tube
[NASA-CASE-LEW-13174-1] N81-12363
Studying the exhaust gas from a post combustion turbojet engine N81-12996
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005

HIGH TEMPERATURE LUBRICANTS
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C --- air breathing engines
[NASA-CR-159794] N81-12227

HIGH TEMPERATURE TESTS
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
Testing program for determining the mechanical properties of concrete to temperatures of 621 C
[CONF-800969-1] N81-12459

HIGHLANDS
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482

HIGHWAYS
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511

HILBERT SPACE
Equivalent Gaussian measures whose R-N derivative is the exponential of a diagonal form
[AD-A090787] N81-12807

HMX
Burning rate transitions for HMX burned as a binderless propellant
[AD-A090389] N81-12258

HODOSCOPES
Optical fibers and avalanche photodiodes for scintillator counters
[BNL-28195] N81-12876

HOLE DISTRIBUTION (ELECTRONICS)
Effect of hole geometry and Electric-Discharge Machining (EDM) on airflow rates through small diameter holes in turbine blade material
[NASA-TP-1716] N81-12089

HOLOGRAPHIC INTERFEROMETRY
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386

HOLOGRAPHY
Research in progress: Antennas, Propagation and Digital Image Processing Group (APDIP) N81-12317
X-ray holography with X-rays
[AD-A090807] N81-12393
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403
Holographic associative memories in document retrieval systems
[BMFT-FB-DV-79-05] N81-12931

HOMING
Error analysis of pursuit and proportional navigation control laws
[AD-A090155] N81-12056

HONEYCOMB CORES
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173

HONEYCOMB STRUCTURES
Investigation of impact damage in sandwich panels with face sheets of composite materials
[NLR-TR-79011-U] N81-12187
Use of ultra-light adhesive for metal honeycomb bonding --- in satellite panels
[SNIAS-801-422-104] N81-12247
Heat pipe honeycomb panel
[NASA-CASE-LAR-12537-1] N81-12362
Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465

HORIZON
Some results of preliminary tests on values of sky-sea contrast (visible horizon) as a function of environmental parameters
[ESA-TT-623] N81-12691

HORN ANTENNAS
Multi-mode horn antenna simulation
[NASA-TM-80705] N81-12298

HOT SURFACES
Heat transfer measurements related to hot turbine components in the von Karman Institute hot cascade tunnel N81-12999

HOT WORKING
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221

HOT-WIRE FLOWMETERS
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390

HOUSTON (TX)
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480

HOVERING STABILITY
Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071

HUBS
Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627

HUMAN BEINGS
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660

HUMAN FACTORS ENGINEERING
Evaluation of Army aviator human factors, fatigue, in a high threat environment
[AD-A090751] N81-12730
Anthropometry: Basic studies and applications. Citations from the NTIS data base
[PB80-813645] N81-12736
Visual scene perception in manual control
[NLR-MP-79045-U] N81-12743

HUMAN PERFORMANCE
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727
Laboratory investigations of biomedical factors influencing laser designator operator performance
[AD-A090425] N81-12739
Night vision devices. Citations from the NTIS data base
[PB80-814957] N81-12879

HUMAN TOLERANCES
XDC-2 digital decompression computer: Assessment of decompression profiles by ultrasonic monitoring, phase 1, 36-54 MSW
[AD-A090467] N81-12729
SPH-4 helmet damage and head injury correlation
[AD-A090750] N81-12740

HUMIDITY MEASUREMENT
Moisture penetration evaluation of polystyrene bead foam as an encapsulant for electronic packages
[BDX-613-2394] N81-12245

HYBRID CIRCUITS
Development of hybrid circuits, a summary
[ESA-CR(P)-1243-REV-B] N81-12350

HYDRATION
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168

HYDRAULIC EQUIPMENT
The investigation into hydraulic gear pump efficiencies in the first few hours of the pumps' lives and a comparative study of accelerated life tests methods on hydraulic fluid power gear pumps, part 3
[AD-A089648] N81-12423

HYDRAULIC FLUIDS
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C --- air breathing engines
[NASA-CR-159794] N81-12227

HYDRAZINE ENGINES
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164

HYDRAZINES
The vapor phase autoxidation of unsymmetrical dimethylhydrazine and 50 percent unsymmetrical dimethylhydrazine 50 percent hydrazine mixtures
[AD-A090281] N81-12261
Study of space micropropulsion by hydrazine thermal decomposition. Laboratory tests
[AAAF-NT-80-28] N81-12281

HYDRIDES
Electronic band structure and optical properties of the cubic, Sc, Y and La hydride systems
[IS-T-899] N81-12918

HYDROCARBON COMBUSTION
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
USAF Aircraft Engine emission goals, a critical review
[AD-A090282] N81-12651

HYDROCARBON FUELS
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197
System design of advanced carbide fuel
[COO-2426-205] N81-12265
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652

HYDROCARBONS
Trace chemical analysis methodology
[AD-A090762] N81-12191
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196

Sampling and analysis of hydrocarbons in combustion gases
[ANL/CEN/FE-80-11] N81-12204

HYDRODYNAMIC EQUATIONS
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883

HYDROELECTRIC POWER STATIONS
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come — federal and state regulatory burdens and the economic market
[DOE/RA-04934/05] N81-12611

HYDROGEN
Passivation of GaAs surfaces
[AD-A090512] N81-12909

HYDROGEN ATOMS
Dynamics of reactions involving hydrogen atom or proton transfer symmetric case
[AD-A090588] N81-12830

HYDROGEN OXYGEN FUEL CELLS
The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569
Fuel cells. Citations from the NTIS data base
[PB80-813389] N81-12641

HYDROGEN PRODUCTION
Thermochemical cycles: A new method of producing hydrogen
[LASL-80-26] N81-12275

HYDROGENATION
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
Studies of the mechanisms of coal hydrogenation by electron spin resonance
[DOE/PC-30072/T1] N81-12272
The flash hydrogenation of biomass
[BNL-28297] N81-12277
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910

HYDROGRAPHY
The dynamics of oceanic fronts. Part 1: The Gulf Stream
[NASA-TM-80335-PT-1] N81-12717

HYDROLOGY
Remote Sensing For Water Resources And Hydrology. Recommended research emphasis for the 1980's
[NASA-CR-163791] N81-12529
Technical regulations: Hydrology and international hydrological codes
[WMO-555] N81-12540

HYDROLYSIS
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168

HYDROSTATICS
Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233

HYGRAL PROPERTIES
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454

HYPERBARIC CHAMBERS
Hyperbaric oxygenation. Citations from the NTIS data base
[PB80-813769] N81-12735

HYPERGEOMETRIC FUNCTIONS
A note on two integrals related with Bessel functions
[MC-TW-199/80] N81-12800

HYPEROXIA
Hyperbaric oxygenation. Citations from the NTIS data base
[PB80-813769] N81-12735

HYPERSONIC FLOW
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
Electron beam measurements of the density in a hypersonic turbulent boundary layer at M = 9
[IC-AERO-80-01] N81-12378

HYPERVELOCITY PROJECTILES
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023

I

IAPETUS
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964

ICE FLOES
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687

IGNEOUS ROCKS
A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
[NASA-TM-82019] N81-12526

IMAGE CONTRAST
Optical and atmospheric optical parameters during visibility tests in the north of Germany, 1977
[ESA-TT-615] N81-12690

IMAGE INTENSIFIERS
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880

IMAGE MOTION COMPENSATION
Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection — detecting aircraft from satellites
[AD-A090644] N81-12146

IMAGE PROCESSING
Forest resource information system — St. Regis Paper Co.
[E81-10004] N81-12481
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps — Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
Earth Observations Division version of the Laboratory for Applications of Remote Sensing System (EOD-LARSYS) user guide for the IBM 370/148. Volume 2: User reference manual
[E81-10010] N81-12487
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
Stratum variance estimation for sample allocation in crop surveys — Great Plains Corridor
[E81-10035] N81-12517
Remote sensing and image interpretation
[E81-10036] N81-12518
Contextual classification of multispectral image data: Approximate algorithm
[E81-10038] N81-12520
Detection of signal signatures of cartographic features
[AD-A090375] N81-12531
A cartographic computer data format and associated programs — for image processing
[RAE-TR-80037] N81-12539
Two experiments on statistical image segmentation
[AD-A089484] N81-12764
A special-purpose processor for an automatic feature extraction system
[AD-A090789] N81-12765
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814239] N81-12784
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814221] N81-12785
Search for faint galactic features — digital image processing
[LA-UR-80-2357] N81-12980
Selenocentric control system (1979)
[AD-A090543] N81-12989

IMAGERY
Development of an electrophoretic image display
[AD-A090574] N81-12396

IMAGES
The use of an arc image furnance for solid propellant ignition studies. An undergraduate student report
[PERME-MEMO-111] N81-12282

IMAGING TECHNIQUES
Research in progress: Antennas, Propagation and Digital Image Processing Group (APDIP)
N81-12317
Fiber optic combiner and duplicator
[NASA-CR-160044] N81-12864
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942

IMPACT DAMAGE
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
Investigation of impact damage in sandwich panels with face sheets of composite materials
[NLR-TR-79011-U] N81-12187
SPH-4 helmet damage and head injury correlation
[AD-A090750] N81-12740

IMPACT LOADS
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263

IMPACT PREDICTION
Improved methods for computing drag corrected missile impact predictions in real time
[AD-A090413] N81-12145

IMPACT TESTS
Contact law and impact responses of laminated composites
[NASA-CR-159884] N81-12172

IMPEDANCE
A phenomenological method of calculating microwave longitudinal coupling impedances
[BNL-51222] N81-12316

IN-FLIGHT MONITORING
Synopsis on aircraft integrated data systems and engine health monitoring and maintenance
[DFVLR-MITT-80-08] N81-12083

INCIDENCE
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537

INCLUSIONS
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872

INCOMPRESSIBLE BOUNDARY LAYER
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382

INDEPENDENT VARIABLES
On a general asymptotic independence: Result in statistics, a preliminary report
[SAAB-FTK-0-79-22] N81-12804

INDIAN OCEAN
The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A — monsoon experiment N81-12710

INDIANA
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans — U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504

INDIUM PHOSPHIDES
Indium phosphide/cadmium sulfide thin-film solar cells
[SERI/PR-8170-1-T1] N81-12616

INDUCTION MOTORS
Three phase power factor controller
[NASA-CASE-MFS-25535-1] N81-12330

INDUSTRIAL ENERGY
Solar-augmented applications in industry
[PB80-205313] N81-12643

INDUSTRIAL PLANTS
Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813405] N81-12755

Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813413] N81-12756

INDUSTRIAL SAFETY
Overall requirements for an advanced underground coal extraction system --- environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523
Evaluation of several methods for assessing the effects of occupational exposure to radiation
[PNL-SA-8438] N81-12733

INDUSTRIES
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170

INELASTIC COLLISIONS
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853

INERTIA PRINCIPLE
Quadric solids and computational geometry
[BDX-613-2484] N81-12794

INERTIAL CONFINEMENT FUSION
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886

INERTIAL COORDINATES
Reference coordinate systems for Earth dynamics: A preview
[NASA-CR-163800] N81-12525

INERTIAL GUIDANCE
SLBM fire control computational algorithms in support of stellar inertial guidance
[AD-A090650] N81-12057
Ring laser gyro
[AD-A090643] N81-12395

INERTIAL NAVIGATION
Astroinertial navigation for cruise applications
[AD-A090649] N81-12059
Field evaluation of the ANS-2000 land navigation system
[AD-A090793] N81-12061

INFESTATION
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707

INFORMATION FLOW
Study of the operational deployment of SIRIO-2 ground stations. Volume 1 --- meteorological data traffic
[ESA-CR(P)-1369-VOL-1] N81-12711

INFORMATION MANAGEMENT
Cataloging procedures for the Library Management and Retrieval System (LMARS)
[AD-A090712] N81-12929
A cataloger's guide to the LMARS report number. Authority file in use at the Naval Underwater Systems Center
[AD-A090713] N81-12930
The foundations of United States information policy
[PB80-204019] N81-12933

INFORMATION RETRIEVAL
Cataloging procedures for the Library Management and Retrieval System (LMARS)
[AD-A090712] N81-12929
A cataloger's guide to the LMARS report number. Authority file in use at the Naval Underwater Systems Center
[AD-A090713] N81-12930
Holographic associative memories in document retrieval systems
[BMFT-FB-DV-79-05] N81-12931
On-line information retrieval systems. Citations from the NTIS data base
[PB80-814841] N81-12934

INFORMATION SYSTEMS
Nondestructive testing information analysis center, 1979
[AD-A090718] N81-12442
Forest resource information system --- St. Regis Paper Co.
[E81-10004] N81-12481
Cataloging procedures for the Library Management and Retrieval System (LMARS)
[AD-A090712] N81-12929
A cataloger's guide to the LMARS report number. Authority file in use at the Naval Underwater Systems Center
[AD-A090713] N81-12930

INFRARED DETECTORS
Advanced IR imaging seeker program
[AD-A090642] N81-12869

INFRARED IMAGERY
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
Two experiments on statistical image segmentation
[AD-A089484] N81-12764
Advanced IR imaging seeker program
[AD-A090642] N81-12869

INFRARED LASERS
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405
Atmospheric effects on laser beams. Citations from the NTIS data base
[PB80-814908] N81-12421

INFRARED PHOTOGRAPHY
A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
[NASA-TM-82019] N81-12526

INFRARED RADIATION
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
Description and utilization of a computation program of the optical radiation transmitted, emitted or diffused by the atmosphere for satellite observation --- spectral domain .3 to 25 microns
[ONERA-NT-1980-3] N81-12878

INFRARED SPECTROMETERS
Design studies for a far infrared absolute spectrometer for the cosmic background explorer
[NASA-CR-160051] N81-12385

INFRARED SPECTROSCOPY
A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
[NASA-TM-82019] N81-12526
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722

INFRARED TRACKING
Advanced IR imaging seeker program
[AD-A090642] N81-12869

INHIBITORS
Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189

INHOMOGENEITY
A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364

INITIATORS (EXPLOSIVES)
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257

INJURIES
Aircraft accident reports. Brief format, US civil aviation: Issue no. 11, 1979 accidents
[NTSB-BA-80-8] N81-12053

INSOLATION
Solar total energy modularity study
[SAND-80-7060] N81-12608
Solar-augmented applications in industry
[PB80-205313] N81-12643

INSTRUMENT FLIGHT RULES
IFR aircraft handled forecast by air route traffic control center, fiscal years 1980-1991
[AD-A090803] N81-12048

INSULATION
Development of a new polyurea foam insulation material
[EUR-6737-EN] N81-12235
High temperature gas-insulated systems
[EPRI-EL-1500] N81-12368
Insulation development for high-temperature batteries for electric vehicle application
[CONS-5160-T1] N81-12571

INSULATORS
Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333

INTEGRAL EQUATIONS
An analysis of the various methods used to analyze radiation from the thin wire E field integral equation
[AD-A090488] N81-12307
Some singular integral equations in linear transport theory
[SAND-80-1069] N81-12795
A note on two integrals related with Bessel functions
[MC-TW-199/80] N81-12800

INTEGRATED CIRCUITS
Physical and chemical processes for the generation of one micrometer structures
[BMFT-FB-T-79-51] N81-12291
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326
A study of trends and techniques for space base electronics
[NASA-CR-161277] N81-12327
C-MOS array design techniques
[NASA-CR-150799] N81-12328
Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333
The compilation of regular expressions into integrated circuits
[AD-A090507] N81-12334
Fundamental limitations of electron beam lithography for future military IC fabrication
[AD-A090407] N81-12336
Microwave integrated circuits procedures evaluation
[AD-A090677] N81-12338
Large scale integrated MOS circuits with small dimensions. Preparation of thin films
[BMFT-FB-T-79-55] N81-12346
Solar cell system having alternating current output
[NASA-CASE-LEW-12806-2] N81-12542
The large scale microelectronics Computer-Aided Design and Test (CADAT) system
[NASA-TM-78202] N81-12747
The PR2D (Place, Route in 2-Dimensions) automatic layout computer program handbook
[NASA-RP-1029] N81-12760

INTELLIGIBILITY
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
Experiments on speech recognition by linear prediction
[ENST-C-79020] N81-12782

INTELSAT SATELLITES
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184

INTERACTIONS
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382

INTERFACES
Microstructure examination of the interface of the glass-ceramic insulator of the molybdenum frame of a vacuum tube
[GEPP-TIS-516] N81-12239

INTERFEROMETERS
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386

INTERFEROMETRY
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889

INTERMITTENCY
Some further thoughts on temporary threshold shift --- hearing and intermittent noise
[RAE-TM-FS-338] N81-12734

INTERMOLECULAR FORCES
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
INTERNAL COMBUSTION ENGINES
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
Current and future needs for engine electronic control sensors N81-12435
INTERNATIONAL COOPERATION
The Western Hemisphere energy system
[GPO-51-683] N81-12557
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program N81-12708
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report N81-12709
Manual on the global data processing system. Volume 2: Regional aspects --- World Meteorological Organization
[WMO-485-VOL-2] N81-12714
Technology transfer to China
[GPO-58-034] N81-12947
Technology transfer to China
[GPO-62-976] N81-12948
INTERNATIONAL RELATIONS
The Moon treaty
[GPO-66-705] N81-12937
Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-68-636] N81-12939
Key issues in US-USSR scientific exchanges and technology transfer
[GPO-50-111] N81-12946
INTERNATIONAL SYSTEM OF UNITS
Oversight hearing: United States Metric Board
[GPO-56-236] N81-12284
INTERPLANETARY MAGNETIC FIELDS
Magnetic field directional discontinuities. 2: Characteristics between 0.46 and 1.0 AU --- interplanetary magnetic fields
[NASA-TM-82036] N81-12963
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968
INTERSECTIONS
Maximizing the intersection density of fiber processes
[CTH-MATH-1980-4] N81-12185
INVENTORY MANAGEMENT
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
INVERTEBRATES
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
INVERTED CONVERTERS (DC TO AC)
Solar cell system having alternating current output
[NASA-CASE-LEW-12806-2] N81-12542
INVISCID FLOW
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382
ION ACOUSTIC WAVES
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
ION BEAMS
Direct-write ion lithography
[AD-A090607] N81-12397
The CISE tandem vandeGraaf accelerator and its fields of use
[CISE-N-191] N81-12820
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886
ION DENSITY (CONCENTRATION)
Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685
ION IMPLANTATION
Trends and techniques for space base electronics --- mathematical models, ion implantation, and semiconductors
[NASA-CR-150825] N81-12329
The use of ion implantation for materials processing
[AD-A090714] N81-12903
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914
ION PLATING
Thin-film coatings N81-12983
ION PROPULSION
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
ION SOURCES
Informal workshop on intense polarized ion sources: A summary
[ANL-80-73] N81-12854
ION TEMPERATURE
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
IONIZATION
Multiple ionization and excitation processes in single ion-atom collisions
[CONF-800859-1] N81-12838
IONIZATION CROSS SECTIONS
Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12847
IONIZING RADIATION
Effect of ionizing radiations on connective tissue
[UR-3490-1900] N81-12732
Microchannel plate as a detector of minimum ionizing particle
[BNL-28279] N81-12845
IONOSPHERE
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
IONOSPHERIC DISTURBANCES
Effects of ionospheric reflection height and ground conductivity on earth-ionosphere waveguide mode and ground-wave attenuation rates
[AD-A090716] N81-12686
IONOSPHERIC ELECTRON DENSITY
The effects of electron-neutral collisions on the intensity of plasma lines
[AD-A090749] N81-12887
IONOSPHERIC F-SCATTER PROPAGATION
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
IONOSPHERIC PROPAGATION
Correlation and prediction of propagation time-delays along earth-space links
[AD-A090441] N81-12313
Effects of ionospheric reflection height and ground conductivity on earth-ionosphere waveguide mode and ground-wave attenuation rates
[AD-A090716] N81-12686
IONOSPHERIC SOUNDING
A computer based ionospheric sounding and HF noise measuring system
[ERL-0146-TR] N81-12299
IOWA
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
IRON COMPOUNDS
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912
ISOTROPIC MEDIA
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic liquid crystals
[NASA-TM-81628] N81-12817
ISOTROPY
Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696
ITERATIVE SOLUTION
Multigrid technique applied to lifting transonic flow using full potential equation
[SAAB-L-0-1-B439] N81-12028
The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470
Convergence of iterative nonexpansive signal reconstruction algorithms
[NASA-CR-163799] N81-12790
IVORY COAST
Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567

J

JET AIRCRAFT
Flight test handbook: Flying qualities theory and flight test techniques
[AD-A090525] N81-12073
JET AIRCRAFT NOISE
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
JET BOUNDARIES
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360
JET CONDENSERS
Open cycle OTEC system with falling jet evaporator and condenser
[SERI/TP-631-791] N81-12573
JET ENGINES
Alternatives for jet engine control N81-12103
Laser interaction with TBR materials
[AD-A090429] N81-12177
USAF Aircraft Engine emission goals, a critical review
[AD-A090282] N81-12651
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825
Are management problems in the acquisition of aircraft gas turbine engines being corrected
[AD-A090520] N81-12928
JET EXHAUST
Trace chemical analysis methodology
[AD-A090762] N81-12191
JET LAG
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727
JET MIXING FLOW
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026
JET PROPULSION
Evaluation of Levinsky's method for the calculation of the lift distribution on a wing in propulsive jets
[NLR-TR-77104-U] N81-12033
JUPITER (PLANET)
The formation of arcs in the dynamic spectra of Jovian decameter bursts
[NASA-TM-81987] N81-12966
JUPITER ATMOSPHERE
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
Energetic particles in the pre-dawn magnetotail of Jupiter
[NASA-TM-81991] N81-12967
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968

JUPITER PROBES
Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body
[NASA-CR-163795] N81-12140

K

KALMAN FILTERS
Optimal estimation of missile free-flight trajectory: Comparative results of linear and nonlinear Kalman filter approaches
[AD-A090717] N81-12144
KANSAS
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
KAPTON (TRADEMARK)
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide --- aerospace materials
[ESA-STM-213] N81-12251
KENTUCKY
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
KERNEL FUNCTIONS
Improved numerical techniques for processing Monte Carlo thermal scattering data
[BNL-28048] N81-12798
Equivalent Gaussian measures whose R-N derivative is the exponential of a diagonal form
[AD-A090787] N81-12807
KETONES
Polyketones and polysulfones for conservation in the ethylene polymer
[BNL-51155] N81-12237
KEVLAR (TRADEMARK)
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249
KRYPTON
Excimer potential curves
[AD-A090516] N81-12414

L

LABORATORY EQUIPMENT
Fractography: A survey
[NLR-MP-77026-U] N81-12473
LAKE SUPERIOR
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
LAKES
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
LAMINAR BOUNDARY LAYER
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382
LAMINAR FLOW
Calculations for nonstationary laminar flow subject to an average deceleration with shearing
[AAAF-NT-80-02] N81-12373
LAMINAR FLOW AIRFOILS
Low drag airfoil design utilizing passive laminar flow and coupled diffusion control techniques
[AD-A090778] N81-12024
LAMINATES
Laminates and reinforced metals
[NASA-TM-81591] N81-12171
Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
Finite element analysis of a dynamically loaded flat laminated plate
[AD-A089985] N81-12787
LAND MANAGEMENT
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
LAND USE
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492
Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952
LANDING
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043
LANDSAT SATELLITES
Space activities in Finland in 1979 N81-12126
LAP JOINTS
Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249
LARGE AREA CROP INVENTORY EXPERIMENT
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
LARGE SCALE INTEGRATION
High speed CMOS/SOS standard cell notebook
[NASA-CR-150783] N81-12323
User's manual for large-scale integrated circuit layout check program
[NASA-TM-78192] N81-12325
Large scale integrated MOS circuits with small dimensions. Preparation of thin films
[BMFT-FB-T-79-55] N81-12346
The large scale microelectronics Computer-Aided Design and Test (CADAT) system
[NASA-TM-78202] N81-12747
LARGE SPACE STRUCTURES
Geostationary platform systems concepts definition follow-on study. Volume 2A: Technical Task 2 LSST special emphasis
[NASA-CR-161597] N81-12133
A technology development program for large space antennas
[NASA-TM-81902] N81-12155
Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445
LASER APPLICATIONS
Laser research and applications
[GPO-66-074] N81-12406
Laser cutting plastic materials
[BDX-613-2476] N81-12417
Laser applications
[BDX-613-2448] N81-12418
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
Applications of optical diagnostic techniques in combustion research N81-13013
LASER DAMAGE
Laser research and applications
[GPO-66-074] N81-12406
LASER DOPPLER VELOCIMETERS
Principle of laser Doppler velocimeter measurements in a fully transparent pump
[VKI-PREPRINT-1979-12] N81-12375
Simultaneous two dimensional measurements with one color laser Doppler velocimeter
[VKI-TM-28] N81-12383
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004
The use of optical techniques in the interpretation of heat transfer measurements N81-13007
A method for the measurements of mixing properties in a flow N81-13015
LASER FUSION
Laser fusion studies at NRL
[AD-A090116] N81-12850
LASER INTERFEROMETRY
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889
LASER MODES
Laser like approach to the dynamics of convective instabilities
[CISE-1533] N81-12371
LASER OUTPUTS
Atmospheric effects on laser beams. Citations from the NTIS data base
[PB80-814908] N81-12421
Laser satellite power systems
[ANL/ES-92] N81-12592
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783
LASER PLASMAS
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889
A computer program for line profile simulations of a laser produced plasma
[CISE-N-187] N81-12901
LASER PUMPING
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560
LASER RANGE FINDERS
High accuracy distance measurement by two-wavelength pulsed laser source
[CISE-N-189] N81-12419
Spaceborne laser range and range rate finder
[ESA-CR(P)-1367] N81-12420
LASER RANGER/TRACKER
Crustal dynamics project observing plan for highly mobile systems 1981 - 1986
[NASA-TM-82029] N81-12680
LASER SPECTROSCOPY
Line shapes in laser experiments
[AD-A090766] N81-12415
Diagnosing combustion by D.R.A.S.C. --- coherent anti-Stokes Raman spectroscopy N81-13009
LASER TARGET DESIGNATORS
Laboratory investigations of biomedical factors influencing laser designator operator performance
[AD-A090425] N81-12739
LASER WEAPONS
B-52 wake investigation
[LOG-C3932] N81-12020

LASERS
Light communications Systems. Citations from the NTIS data base
[PB80-815301] N81-12321
Laser research and applications
[GPO-66-074] N81-12406
Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560

LATITUDE
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection
[NASA-TM-81998] N81-12528

LATTICE PARAMETERS
Improved numerical techniques for processing Monte Carlo thermal scattering data
[BNL-28048] N81-12798

LATTICES (MATHEMATICS)
A characterization of Gorenstein orders in quaternion algebras
[CTH-MATH-1980-6] N81-12816

LAYOUTS
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326

LEAD ACID BATTERIES
Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619
Research, development and demonstration of lead-acid batteries for electric vehicle propulsion
[ANL/OEPM-79-7] N81-12954

LEAD OXIDES
A preliminary investigation of the behavior of titanium-lead dioxide electrodes
[ECRC/M1266] N81-12349

LEAD TITANATES
Microstructure and domain structure of PZT --- piezoelectric materials
[LBL-10651] N81-12917

LEAKAGE
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444

LEAR JET AIRCRAFT
Aircraft accident report: Champion Home Builders company, Gates Learjet 25B, N999HG, Sanford, North Carolina, September 8, 1977
[NTSB-AAR-79-15] N81-12046

LEAST SQUARES METHOD
Nonlinear chi-square algorithm: An improvement on nonlinear least squares
[AD-A090420] N81-12792

LEAVES
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707

LENSES
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386

LIBRARIES
Cataloging procedures for the Library Management and Retrieval System (LMARS)
[AD-A090712] N81-12929

LIFE (DURABILITY)
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164
Pressure vessels for coal liquefaction: An overview
[IS-M-282] N81-12429
Application of fracture mechanics to US Air Force aircraft structural integrity requirements
[AAAF-NT-79-25] N81-12463

LIFE CYCLE COSTS
Naval aircraft operating and support cost-estimating model: FY78 revision
[AD-A090044] N81-12013

LIFT
A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
Evaluation of Levinsky's method for the calculation of the lift distribution on a wing in propulsive jets
[NLR-TR-77104-U] N81-12033
Three component measurements on a body with various afterbody configurations in subsonic and transonic flow
[ESA-TT-628] N81-12151

LIGHT (VISIBLE RADIATION)
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886
Electronic band structure and optical properties of the cubic, Sc, Y and La hydride systems
[IS-T-899] N81-12918

LIGHT BEAMS
Laser cooling and trapping of neutral atoms
[AD-A090760] N81-12408

LIGHT SCATTERING
Brillouin scattering studies of the effect of orientation on the mechanically deformed poly-(ethylene terepthalate)
[AD-A090589] N81-12866
The study of turbulent diffusion flames: Modeling needs and experimental light scattering capabilities N81-13011

LIGNIN
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196

LINE SPECTRA
Line shapes in laser experiments
[AD-A090766] N81-12415
A computer program for line profile simulations of a laser produced plasma
[CISE-N-187] N81-12901

LINEAR PREDICTION
Experiments on speech recognition by linear prediction
[ENST-C-79020] N81-12782

LINEAR PROGRAMMING
Experiment in multiple-criteria energy policy analysis
[BNL-28154] N81-12594

LINEAR SYSTEMS
Some singular integral equations in linear transport theory
[SAND-80-1069] N81-12795

LIQUID COOLING
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
[DS-ERT-14/80] N81-12381

LIQUID CRYSTALS
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic liquid crystals
[NASA-TM-81628] N81-12817

LIQUID FLOW
Two-phase critical flow of saturated and subcooled liquids through valves
[ANL/RAS/LWR-79-7] N81-12370

LIQUID ROCKET PROPELLANTS
Study of space micropropulsion by hydrazine thermal decomposition. Laboratory tests
[AAAF-NT-80-28] N81-12281

LIQUID WASTES
State-of-the-art report on low-level radioactive waste treatment
[ORNL/TM-7427] N81-12858

LIQUID-SOLID INTERFACES
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873

LIQUIDS
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004

LITHIUM
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920

LITHIUM ALLOYS
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615

LITHIUM PERCHLORATES
The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568

LITHOGRAPHY
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
Development of an electrophoretic image display
[AD-A090574] N81-12396
Direct-write ion lithography
[AD-A090607] N81-12397

LOAD DISTRIBUTION (FORCES)
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
A modified T-value method for selection of strain gages for measuring loads on a low aspect ratio wing
[NASA-TP-1748] N81-12066

LOAD TESTS
Effect of various surface protections on the stress corrosion behavior of light alloys --- aluminum alloys
[SNIAS-801-551-102] N81-12220

LOADS (FORCES)
Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286

LOGIC CIRCUITS
High speed CMOS/SOS standard cell notebook
[NASA-CR-150783] N81-12323
C-MOS array design techniques
[NASA-CR-150799] N81-12328
The compilation of regular expressions into integrated circuits
[AD-A090507] N81-12334
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
Development of Boolean calculus and its applications --- digital systems design
[NASA-CR-163802] N81-12786

LOGICAL ELEMENTS
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326

LONGITUDE
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection
[NASA-TM-81998] N81-12528

LOUISIANA
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486

LOW COST
Low cost thin film polycrystalline silicon solar cells
[DOE/ET-23048/T1] N81-12603

LOW DENSITY MATERIALS
Development of a new polyurea foam insulation material
[EUR-6737-EN] N81-12235

LOW TEMPERATURE
Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904
Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915

LOW TEMPERATURE PHYSICS
Investigation of noise in solids at low temperatures
[AD-A090805] N81-12907

LUBRICATION SYSTEMS
Self-lubricating composite materials N81-12984

LUMINOUS INTENSITY
An X-ray survey of nine historical novae --- HEAO 2 observations
[NASA-TM-82014] N81-12961

LUNAR PHOTOGRAPHY
Selenocentric control system (1979)
[AD-A090543] N81-12989

LUNAR SURFACE
Selenocentric control system (1979)
[AD-A090543] N81-12969
LUNGS
Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719

M

MACH NUMBER
Fast deflagration waves
[AD-A090776] N81-12190
In-flight boundary-layer measurements on a hollow cylinder at a Mach number of 3.0
[NASA-TP-1764] N81-12361
MACHINING
Effect of hole geometry and Electric-Discharge Machining (EDM) on airflow rates through small diameter holes in turbine blade material
[NASA-TP-1716] N81-12089
Metallurgical aspects of materials processing and manufacturing for aero-engine components --- gas turbine engines
[PNR-90019] N81-12209
Report on explosives machining
[AD-A090732] N81-12259
Deburring: Technical capabilities and cost-effective approaches, lessons 5 and 6
[BDX-613-2382] N81-12288
MAGNETIC ANOMALIES
Magnetic field directional discontinuities. 2: Characteristics between 0.46 and 1.0 AU --- interplanetary magnetic fields
[NASA-TM-82036] N81-12963
MAGNETIC DIPOLES
Studies related to Magsat
[E81-10016] N81-12493
Equivalent source modeling of the main field using Magsat data
[E81-10026] N81-12503
MAGNETIC EQUATOR
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
MAGNETIC FIELD CONFIGURATIONS
Modeling of compressed magnetic field generators by equivalent circuit approach
[AWRE-O-21/80] N81-12351
Toroidal plasma equilibrium with gravity --- stellar magnetic fields
[PPPL-1704] N81-12895
Magnetic field directional discontinuities. 2: Characteristics between 0.46 and 1.0 AU --- interplanetary magnetic fields
[NASA-TM-82036] N81-12963
MAGNETIC FIELDS
Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818
Optical fibers and avalanche photodiodes for scintillator counters
[BNL-28195] N81-12876
Spinning plasma ring stable to tilting mode
[IPPJ-478] N81-12884
Strongly-localized ballooning modes in a tandem mirror
[SAI-254-80-493-LJ] N81-12890
Pulsar gamma-rays: Spectra luminosities and efficiencies
[NASA-TM-82026] N81-12962
MAGNETIC FLUX
Studies related to Magsat
[E81-10016] N81-12493
MAGNETIC MIRRORS
Neutral beam development plan
[DOE/ER-0075] N81-12856
MAGNETIC PROPERTIES
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic liquid crystals
[NASA-TM-81628] N81-12817
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
MAGNETIC RESONANCE
Coal thickness guage using RRAS techniques, parts 2 and 3
[NASA-CR-161607] N81-12524
MAGNETIC STARS
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
MAGNETIC STORMS
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
MAGNETICALLY TRAPPED PARTICLES
Reduction and analysis of ATS-6 data
[NASA-CR-160052] N81-12683
MAGNETOACOUSTIC WAVES
Absorption of magnetoacoustic waves in a high beta plasma
[IPF-79-3] N81-12900
MAGNETOELECTRIC MEDIA
Maxwell-Vlasov equations as a continuous Hamiltonian system
[PPPL-1702] N81-12797
MAGNETOHYDRODYNAMIC FLOW
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968
MAGNETOHYDRODYNAMIC GENERATORS
Analytical investigation of critical phenomena in MHD power generators
[NASA-CR-165143] N81-12546
Effect of wetting layer and void fraction nonuniformity on the characteristics of a two-phase liquid-metal MHD generator
[LOG-E379] N81-12881
MHD heat and seed recovery technology project
[ANL/MHD-80-1] N81-12898
MAGNETOHYDRODYNAMIC STABILITY
Lower-hybrid-drift instability with axis encircling ions
[SAI-254-80-477-LJ] N81-12893
MAGNETOHYDRODYNAMIC WAVES
Super-alfvenic propagation of cosmic rays: The role of streaming modes
[NASA-TM-82032] N81-12975
MAGNETOHYDRODYNAMICS
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891
Nonlinear magnetohydrodynamics
[ORO-5260-4] N81-12896
Computational physics program of the National MFE Computer Center
[UCID-175530-REV-1] N81-12927
MAGNETOMETERS
Magsat vector magnetometer calibration using Magsat geomagnetic field measurements
[NASA-TM-82046] N81-12527
MAGNETOPAUSE
A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
MAGNETOSPHERE
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
Reduction and analysis of ATS-6 data
[NASA-CR-160052] N81-12683
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968
MAGNETS
Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818
MAGSAT 1 SATELLITE
Studies related to Magsat
[E81-10016] N81-12493
Magsat vector magnetometer calibration using Magsat geomagnetic field measurements
[NASA-TM-82046] N81-12527
MAINTENANCE
Spent fuel handling and packaging program
[DOE/NV-10061/3] N81-12851
MAN MACHINE SYSTEMS
Mathematical models of pilot-helicopter systems
[NLR-MP-79026-U] N81-12742
MANAGEMENT METHODS
Economic analysis procedures for ADP
[AD-A089826] N81-12936
MANEUVERABILITY
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424
AMARV high reliability piece part
[AD-A090577] N81-12441
MANIFOLDS
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
MANNED SPACECRAFT
Flammability testing --- aerospace materials
[ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
MANUAL CONTROL
Visual scene perception in manual control
[NLR-MP-79045-U] N81-12743
MANUALS
Manual on the global data processing system. Volume 2: Regional aspects --- World Meteorological Organization
[WMO-485-VOL-2] N81-12714
MANUFACTURING
Laser applications
[BDX-613-2448] N81-12418
Development of a low-cost solar panel using laminated polymer films
[ALO-4121-2] N81-12577
Research, development and demonstration of lead-acid batteries for electric vehicle propulsion
[ANL/OEPM-79-7] N81-12954
MAPPING
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
Selenocentric control system (1979)
[AD-A090543] N81-12969
MAPS
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
MARINE BIOLOGY
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
MARINE ENVIRONMENTS
Surface effect vehicle/ships in Marine environments. Citations from the NTIS data base
[PB80-814528] N81-12293
The 1980 status report on low-level, atmospheric turbulence model for marine environments
[AD-A090576] N81-12701
MARINE METEOROLOGY
Further study of the variability in the frequency of typhoon formation over the West Pacific ocean
[COO-1340-75] N81-12702
MARITIME SATELLITES
NOSS flight segment concept study
[NASA-TM-82307] N81-12124
MARKET RESEARCH
Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039
MARKOV CHAINS
On the smoothness of Markov chain transition functions
[CTH-MATH-1980-5] N81-12810
MARKOV PROCESSES
Algorithmic solution of some queues with overflows
[AD-A090771] N81-12779
Optimal regulation in systems with stochastic time sampling
[NASA-TP-1743] N81-12812

MARS ENVIRONMENT
Mars environment. Citations from the NTIS data base
[PB80-814999] N81-12970
MARS SURFACE
Mars environment. Citations from the NTIS data base
[PB80-814999] N81-12970
MARSHLANDS
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
MASKING
Physical and chemical processes for the generation of one micrometer structures
[BMFT-FB-T-79-51] N81-12291
MASS SPECTRA
Mass measurement with the electron microscope
[BNL-25536] N81-12400
MASS TRANSFER
Turbulent mixing and concentration measurement
[VKI-PREPRINT-1980-8] N81-12377
MATCHED FILTERS
Acoustoelectric devices: A new technology for waveform-agile radar
[AD-A090646] N81-12311
MATERIALS HANDLING
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
MATERIALS RECOVERY
Alternative process schemes for coal conversion
[BNL-51233] N81-12278
MATHEMATICAL LOGIC
Decidability and expressiveness of logics of processes
[AD-A090688] N81-12788
MATHEMATICAL MODELS
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090031] N81-12026
Boundary layer measurements on a two dimensional wing with flap and a comparison with calculations
[NLR-MP-79034-U] N81-12036
Multivariable identification using centralized fixed modes N81-12091
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262
Surface effect vehicles and surface effect: General studies. Citations from the NTIS data base
[PB80-814551] N81-12294
Transmission of electromagnetic radiation through non-planar layered media
[AD-A089937] N81-12303
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12318
Trends and techniques for space base electronics --- mathematical models, ion implantation, and semiconductors
[NASA-CR-150825] N81-12329
Modeling of compressed magnetic field generators by equivalent circuit approach
[AWRE-O-21/80] N81-12351
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
Equivalent source modeling of the main field using Magsat data
[E81-10026] N81-12503
Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574
Preliminary designs: Passive solar manufactured housing
[DOE/CS-30377/1] N81-12583
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells
[DOE/ET-23108/4] N81-12601
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
Summary of pacific missile test center meteorological support Air Quality Assessment Model (AQAM) tests at the Naval Air Station, Mirimar, 1 to 8 August 1979
[AD-A090529] N81-12650
The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652
Effects of ionospheric reflection height and ground conductivity on earth-ionosphere waveguide mode and ground-wave attenuation rates
[AD-A090716] N81-12686
On parachutist dynamics
[AD-A090335] N81-12741
Mathematical models of pilot-helicopter systems
[NLR-MP-79026-U] N81-12742
Finite element analysis of a dynamically loaded flat laminated plate
[AD-A089985] N81-12787
Decidability and expressiveness of logics of processes
[AD-A090688] N81-12788
An algorithm module for abstract algebra N81-12803
Clines in the presence of asymmetric migration
[MC-TW-200/80] N81-12811
Transonic rotor noise - theoretical and experimental comparisons
[AD-A090806] N81-12824
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883
MATHEMATICAL PROGRAMMING
A natural data type with a finite equational final semantics specification but no effective equational initial semantics specification
[MC-IW-133/80] N81-12799
MATHIEU FUNCTION
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
MATRICES (MATHEMATICS)
A comparison of methods for calibration and use of multi-component strain gauge wind tunnel balances
[AD-A090484] N81-12394
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778
A historically motivated study of families of Pythagorean or Babylonian triples and their generating semigroups of p- or b-orthonormal matrices
[CTH-MATH-1980-3] N81-12815
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872
MAXIMUM LIKELIHOOD ESTIMATES
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
MAXWELL EQUATION
Maxwell-Vlasov equations as a continuous Hamiltonian system
[PPPL-1702] N81-12797
MECHANICAL DEVICES
Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286
Whole new world of miniature technology
[BDX-613-2277] N81-12289
Automatic scene analysis. Second contract report
[ENST-D-79024] N81-12776
MECHANICAL DRIVES
Hybrid vehicle potential assessment. Volume 9: Power train summary, component descriptions, and HYVEC vehicle simulator
[CONS-4209-T1-VOL-9] N81-12949
MECHANICAL ENGINEERING
Whole new world of miniature technology
[BDX-613-2277] N81-12289
MECHANICAL MEASUREMENT
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403
Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468
MECHANICAL PROPERTIES
Laser interaction with TBR materials
[AD-A090429] N81-12177
Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
Test methods for the dynamic mechanical properties of polymeric materials
[BDX-613-2405] N81-12245
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457
Testing program for determining the mechanical properties of concrete to temperatures of 621 C
[CONF-800969-1] N81-12459
MECHANICAL SHOCK
Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286
MECHANIZATION
Inert gas welding. Citations from the Engineering Index data base
[PB80-815228] N81-12436
Automated linear concentrator cell module assembly
[SAND-80-7103] N81-12610
MEDICAL EQUIPMENT
Acoustic tooth cleaner
[NASA-CASE-LAR-12471-1] N81-12724
MEDICAL SCIENCE
Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719
MEDITERRANEAN SEA
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
MELLIN TRANSFORMS
A note on two integrals related with Bessel functions
[MC-TW-199/80] N81-12800
MERCURY CADMIUM TELLURIDES
The extension of (Hg, Cd)Te detector technology to the near millimeter spectral region
[AD-A090449] N81-12867
MESOSPHERE
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679

METAL COATINGS
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
METAL FATIGUE
Experimental methodology. Application of concepts from mechanics to material rupture studies
[SNIAS-801-551-104] N81-12466
METAL FOILS
Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390
Ultrasonic seam welding
[BDX-613-2444] N81-12431
METAL MATRIX COMPOSITES
Laminates and reinforced metals
[NASA-TM-81591] N81-12171
METAL OXIDE SEMICONDUCTORS
Trends and techniques for space base electronics --- mathematical models, ion implantation, and semiconductors
[NASA-CR-150825] N81-12329
Large scale integrated MOS circuits with small dimensions. Preparation of thin films
[BMFT-FB-T-79-55] N81-12346
Design, development, fabrication and delivery of register and multiplexer units --- CMOS monolithic chip development
[NASA-CR-150801] N81-12746
The PR2D (Place, Route in 2-Dimensions) automatic layout computer program handbook
[NASA-RP-1029] N81-12760
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910
METAL SHEETS
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
METAL WORKING
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221
METAL-METAL BONDING
Use of ultra-light adhesive for metal honeycomb bonding --- in satellite panels
[SNIAS-801-422-104] N81-12247
Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249
METALLIC HYDROGEN
Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157
METALLIZING
A study of trends and techniques for space base electronics
[NASA-CR-161277] N81-12327
Trends and techniques for space base electronics --- mathematical models, ion implantation, and semiconductors
[NASA-CR-150825] N81-12329
Comparison of metallization systems for thin film hybrid microcircuits
[BDX-613-2489] N81-12344
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
METALLOGRAPHY
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457
METEOROLOGICAL PARAMETERS
A set of computer programs to process turbulence data measured at the 200 m mast at Cabauw, Netherlands
[KNMI-WR-80-3] N81-12706
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707
METEOROLOGICAL RADAR
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
METEOROLOGICAL SATELLITES
A simulation study on the impact of satellite sensed winds on tropical cyclone forecast
[AD-A090322] N81-12699
METEOROLOGY
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967 - 1980 reference book, volume 1
[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138
Summary of pacific missile test center meteorological support Air Quality Assessment Model (AQAM) tests at the Naval Air Station, Mirimar, 1 to 8 August 1979
[AD-A090529] N81-12650
A description of the NSSL cases used for a simulated VAS retrieval study
[NASA-TM-82023] N81-12678
Atmospheric echo sounding. Citations from the NTIS data base
[PB80-815004] N81-12694
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program
N81-12708
METRICATION
Oversight hearing: United States Metric Board
[GPO-56-236] N81-12284
METROLOGY
A new method of roundness measurement by capacitative detectors
[ESA-TT-635] N81-12292
MICHELSON INTERFEROMETERS
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12677
MICROCHANNEL PLATES
Microchannel plate as a detector of minimum ionizing particle
[BNL-28279] N81-12845
MICROCOMPUTERS
DFT decomposition and implementation for concurrent execution on multiple processing elements
[AD-A090725] N81-12748
Data acquisition from a digital voltmeter using a CBM PET 2001 microcomputer with particular reference to microelectronic wire bond testing
[AWRE-O-16/80] N81-12753
Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813405] N81-12755
Microcomputers: Industrial process control applications. Citations from the Engineering Index data base
[PB80-813413] N81-12756
The multiple stack algorithm implemented on a Zilog Z-80 microcomputer
[AD-A090606] N81-12791
MICROCRACKS
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452
MICROELECTRONICS
Comparison of metallization systems for thin film hybrid microcircuits
[BDX-613-2489] N81-12344
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
The large scale microelectronics Computer-Aided Design and Test (CADAT) system
[NASA-TM-78202] N81-12747
MICROMINIATURIZATION
Physical and chemical processes for the generation of one micrometer structures
[BMFT-FB-T-79-51] N81-12291
MICROORGANISMS
Mass measurement with the electron microscope
[BNL-25536] N81-12400
MICROPHONES
A comparison of the three methods used to obtain acoustic measurements for the NASA Flight Effects Program
[NASA-TM-81906] N81-12822
MICROPROCESSORS
New techniques for test development for tactical auto-pilots using microprocessors
[AD-A090641] N81-12149
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
XDC-2 digital decompression computer: Assessment of decompression profiles by ultrasonic monitoring, phase 1, 36-54 MSW
[AD-A090467] N81-12729
DFT decomposition and implementation for concurrent execution on multiple processing elements
[AD-A090725] N81-12748
MICROSTRUCTURE
Influence of thermomechanical treatment on microstructure and mechanical properties of high-strength aluminum alloys
[ESA-TT-507] N81-12222
Microstructure examination of the interface of the glass-ceramic insulator of the molybdenum frame of a vacuum tube
[GEPP-TiS-516] N81-12239
MICROTHRUST
Study of space micropropulsion by hydrazine thermal decomposition. Laboratory tests
[AAAF-NT-80-28] N81-12281
MICROWAVE CIRCUITS
Microwave integrated circuits procedures evaluation
[AD-A090677] N81-12338
MICROWAVE COUPLING
A phenomenological method of calculating microwave longitudinal coupling impedances
[BNL-51222] N81-12316
MICROWAVE EMISSION
Gigawatt microwave emission from a relativistic reflex triode
[AD-A090598] N81-12335
MICROWAVE EQUIPMENT
Microwave integrated circuits procedures evaluation
[AD-A090677] N81-12338
MICROWAVE FREQUENCIES
Test and evaluation of water vapor radiometers
[NASA-CR-160043] N81-12391
MICROWAVE LANDING SYSTEMS
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054
MICROWAVE OSCILLATORS
Millimeter-wave self mixing oscillators
[AD-A090384] N81-12337
MICROWAVE RADIOMETERS
Multi-mode horn antenna simulation
[NASA-TM-80705] N81-12298
Developments in United Kingdom waveguide power standards
[RSRE-80006] N81-12319
Test and evaluation of water vapor radiometers
[NASA-CR-160043] N81-12391
MICROWAVE TRANSMISSION
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560
MICROWAVE TUBES
Gigawatt microwave emission from a relativistic reflex triode
[AD-A090598] N81-12335
MICROWAVES
Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720

MIDAIR COLLISIONS
Aircraft accident reports. Brief format, US civil aviation: Issue no. 11, 1979 accidents
[NTSB-BA-80-8] N81-12053

MIE SCATTERING
Droplet size measurements in combustion by the visibility method N81-13014

MIGRATION
Clines in the presence of asymmetric migration
[MC-TW-200/80] N81-12811

MILITARY SPACECRAFT
Mission integration study for solid Teflon pulsed plasma millipound propulsion system
[AD-A090514] N81-12162

MILITARY TECHNOLOGY
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547

MILITARY VEHICLES
Optical and atmospheric optical parameters during visibility tests in the north of Germany, 1977
[ESA-TT-615] N81-12690

MILLIMETER WAVES
Frequency diverse tracking/guidance millimeter radar adapted to target acquisition
[AD-A090355] N81-12305

Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333

The extension of (Hg, Cd)Te detector technology to the near millimeter spectral region
[AD-A090449] N81-12867

Second harmonic generation of near millimeter wave radiation by nonlinear bulk material
[AD-A090351] N81-12906

MINES (EXCAVATIONS)
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission) --- Yerington, Nevada mine area
[E81-10018] N81-12495

MINIATURIZATION
Whole new world of miniature technology
[BDX-613-2277] N81-12289

MINICOMPUTERS
Computer aided control system design. A conversion report
[CRI-110] N81-12752

MINING
Overall requirements for an advanced underground coal extraction system --- environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523

Coal thickness guage using RRAS techniques, parts 2 and 3
[NASA-CR-161607] N81-12524

MINNESOTA
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505

Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508

A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509

MIRAGE AIRCRAFT
Mirage 2000 and Mirage 4000 fiber structures
[AAAF-NT-79-44] N81-12183

MIRRORS
Heliostat mirror survey and analysis
[PNL-3194] N81-12609

Strongly-localized ballooning modes in a tandem mirror
[SAI-254-80-493-LJ] N81-12890

MISSILE CONTROL
New techniques for test development for tactical auto-pilots using microprocessors
[AD-A090641] N81-12149

Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783

Advanced IR imaging seeker program
[AD-A090642] N81-12869

MISSILE SYSTEMS
Effects of advances in propulsion technology on missile effectiveness --- solid fuel ramjets
[AD-A090645] N81-12106

MISSILE TRAJECTORIES
Optimal estimation of missile free-flight trajectory: Comparative results of linear and nonlinear Kalman filter approaches
[AD-A090717] N81-12144

Improved methods for computing drag corrected missile impact predictions in real time
[AD-A090413] N81-12145

MISSILES
SLBM fire control computational algorithms in support of stellar inertial guidance
[AD-A090650] N81-12057

MISSION PLANNING
NOSS flight segment concept study
[NASA-TM-82307] N81-12124

BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128

BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129

United States civilian space policy
[GPO-66-883] N81-12941

MISSISSIPPI RIVER (US)
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505

LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506

Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508

MISSOURI
Minimum variance geographic sampling
[E81-10033] N81-12515

MIST
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715

MIXING CIRCUITS
Millimeter-wave self mixing oscillators
[AD-A090384] N81-12337

MODAL RESPONSE
Seismic response analysis for structures with non-orthogonal modes
[DP-MS/79-78] N81-12290

The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470

MOISTURE
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454

MOISTURE CONTENT
Moisture penetration evaluation of polystyrene bead foam as an encapsulant for electronic packages
[BDX-613-2394] N81-12245

Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411

A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505

A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509

Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511

MOLDING MATERIALS
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170

MOLECULAR ABSORPTION
Atmospheric effects on laser beams. Citations from the NTIS data base
[PB80-814908] N81-12421

MOLECULAR BEAMS
The decomposition of N2O on Ni (110)
[AD-A090552] N81-12193

MOLECULAR COLLISIONS
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831

Electronic excitation in molecular collisions structural dynamic and kinetic considerations
[AD-A090287] N81-12833

MOLECULAR ELECTRONICS
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597

MOLECULAR ENERGY LEVELS
Excimer potential curves
[AD-A090516] N81-12414

MOLECULAR EXCITATION
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference
[LBL-9501-VOL-2] N81-12835

MOLECULAR INTERACTIONS
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829

MOLECULAR IONS
C3,4,5(plus) and NCO(plus, minus) molecular ion structure determination by Coulomb explosion
[BNL-27326] N81-12844

MOLECULAR RELAXATION
A reinvestigation of transients in the cyclopropane system by the variable encounter method
[AD-A090168] N81-12228

Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263

MOLECULAR STRUCTURE
C3,4,5(plus) and NCO(plus, minus) molecular ion structure determination by Coulomb explosion
[BNL-27326] N81-12844

MOLECULAR WEIGHT
Mass measurement with the electron microscope
[BNL-25536] N81-12400

MOLYBDENUM OXIDES
Microstructure examination of the interface of the glass-ceramic insulator of the molybdenum frame of a vacuum tube
[GEPP-TIS-516] N81-12239

The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568

MOMENTS OF INERTIA
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142

MOMENTUM
Fast deflagration waves
[AD-A090776] N81-12190

MONITORS
A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462

MONOCHROMATIC RADIATION
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387

MONSOONS
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report N81-12709

The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A --- monsoon experiment N81-12710

MONTE CARLO METHOD
Quadric solids and computational geometry
[BDX-613-2484] N81-12794

Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12847

MOON
The Moon treaty
[GPO-66-705] N81-12937

Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-68-838] N81-12939

MORPHOLOGY
Morphology and phase composition of an amine cured rubber modified epoxy
[SAND-80-1914C] N81-12242

MOSSBAUER EFFECT
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911

MOTOR VEHICLES
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424
MTBF
On the decision to replace a unit early or late: A graphical solution
[SAAB-FTK-0-79-19] N81-12438
MULTILAYER INSULATION
Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
MULTIPATH TRANSMISSION
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
MULTIPHASE FLOW
A method for the measurements of mixing properties in a flow N81-13015
MULTIPLEXING
Design, development, fabrication and delivery of register and multiplexer units --- CMOS monolithic chip development
[NASA-CR-150801] N81-12746
MULTIPLIERS
Efficient multipliers for the FFT
[AD-A090648] N81-12789
In search of correlation in multiplicative congruential generators with modulus (2 to the 31st power) minus 1
[AD-A090636] N81-12808
MULTIPROCESSING (COMPUTERS)
A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462
Multipurpose reconfigurable simulator --- computers multiprocessing
[ESS/SS-983] N81-12754
An overview of reliable computer system design
[RSRE-80003] N81-12775
MULTISPECTRAL BAND SCANNERS
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
MULTISTAGE ROCKET VEHICLES
IRIS derived rocket (IDR) to be used as Ariane 4th stage
[ESA-CR(P)-1370] N81-12166
MULTIVARIATE STATISTICAL ANALYSIS
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
MUONS
Studies of heavy ion reactions and transuranic nuclei
[COO-3496-75] N81-12841

N

NACELLES
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
The development of the composite material engine nacelle
[AAAF-NT-79-38] N81-12180
NASA PROGRAMS
NASA authorization, 1982 (program review), volume 1
[GPO-68-972] N81-12938
United States civilian space policy
[GPO-66-883] N81-12941
Research and technology of the Langley Research Center
[NASA-TM-81910] N81-12977
Solar photovoltaics: Stand alone applications --- NASA Lewis Research Center research and development N81-12990
NASTRAN
OPTIM III: A NASTRAN compatible large scale automated minimum weight design problem. Users and programmers manual
[AD-A090334] N81-12458
GRID and CQUAD: Two preprocessing codes for NASTRAN
[AD-A090664] N81-12460
NAVIER-STOKES EQUATION
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023
Turbulent solution of the Navier-Stokes equations
[NASA-TM-81621] N81-12358
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365
Method for calculating two dimensional sheared flow at high Reynolds numbers --- for viscous fluids
[AAAF-NT-80-01] N81-12372
The dynamics of oceanic fronts. Part 1: The Gulf Stream
[NASA-TM-80335-PT-1] N81-12717
NAVIGATION
Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060
NAVIGATION AIDS
LR-80 flight test report --- attitude and heading reference system
[AD-A090284] N81-12058
NAVY
Naval aircraft operating and support cost-estimating model: FY78 revision
[AD-A090044] N81-12013
NECK (ANATOMY)
On parachutist dynamics
[AD-A090335] N81-12741
NETWORK ANALYSIS
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326
On developing a theory of distributed computing summary of current research
[AD-A090773] N81-12750
NETWORK SYNTHESIS
Automatic construction of semantic networks
[BMFT-FB-ID-79-05] N81-12781
NEUTRAL BEAMS
Laser cooling and trapping of neutral atoms
[AD-A090760] N81-12408
Neutral beam development plan
[DOE/ER-0075] N81-12856
NEUTRAL PARTICLES
The effects of electron-neutral collisions on the intensity of plasma lines
[AD-A090749] N81-12887
NEUTRINOS
Looking for heavier weak bosons with DUMAND
[NASA-TM-82027] N81-12828
NEUTRON CROSS SECTIONS
Graphs of the cross sections in the Alternate Monte Carlo Cross Section library at the Los Alamos Scientific Laboratory
[LA-8394-MS] N81-12793
Improved numerical techniques for processing Monte Carlo thermal scattering data
[BNL-28048] N81-12798
NEUTRON IRRADIATION
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925
NEUTRON SCATTERING
Nondestructive testing of armament-system components by means of neutron diffraction
[AD-A090433] N81-12443
NEUTRON STARS
White dwarf models for type 1 supernovae and quiet supernovae, and presupernova evolution
[NASA-TM-82030] N81-12957
NEVADA
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission) --- Yerington, Nevada mine area
[E81-10018] N81-12495
NEW MEXICO
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
NICKEL
The decomposition of N2O on Ni (110)
[AD-A090552] N81-12193
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
NICKEL ALLOYS
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
NICKEL PLATE
The improvement of external lead bond and flexure strengths by comparing lead base materials
[BDX-613-2339] N81-12219
NICKEL ZINC BATTERIES
Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953
NIGERIA
Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567
NIGHT
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
NIGHT VISION
Night vision devices. Citations from the NTIS data base
[PB80-814957] N81-12879
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880
NITRIC OXIDE
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197
Nitric oxide cooling in the terrestrial thermosphere
[AERONOMICA-ACTA-A-214-1980] N81-12673
NITROGEN
Passivation of GaAs surfaces
[AD-A090512] N81-12909
NITROGEN OXIDES
The decomposition of N2O on Ni (110)
[AD-A090552] N81-12193
The application of UV spectroscopy to the qualtitative analysis of nitrogen oxide N81-13008
NITROUS OXIDES
Production of nitrous oxide in a rocket motor exhaust
[PERME-MEMO-96] N81-12167
NOISE (SOUND)
Some further thoughts on temporary threshold shift --- hearing and intermittent noise
[RAE-TM-FS-338] N81-12734
NOISE INTENSITY
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
NOISE MEASUREMENT
A computer based ionospheric sounding and HF noise measuring system
[ERL-0146-TR] N81-12299
A comparison of the three methods used to obtain acoustic measurements for the NASA Flight Effects Program
[NASA-TM-81906] N81-12822
Spectral analysis of nonstationary random processes. Application to noise of flyover type
[ESA-TT-639] N81-12826
Noise measurements and the dB --- errors
[RAE-TM-FS-348] N81-12827
NOISE POLLUTION
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
NOISE REDUCTION
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043

Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) --- Lewis 9 by 15 foot low speed wind tunnel tests
[NASA-TP-1178] N81-12084
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
Stochastic approximation with discontinuous dynamics and state dependent noise w.p.1 convergence
[AD-A089777] N81-12805
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825
Night vision devices. Citations from the Engineering Index data base
[PB80-814932] N81-12880

NOISE SPECTRA
Spectral analysis of nonstationary random processes. Application to noise of flyover type
[ESA-TT-639] N81-12826

NONDESTRUCTIVE TESTS
Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070
Simultaneous measurement of multilayered composites
[BDX-613-2407] N81-12178
Testing of composite structures
[AAAF-NT-79-41] N81-12181
Mirage 2000 and Mirage 4000 fiber structures
[AAAF-NT-79-44] N81-12183
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236
Inert gas welding. Citations from the NTIS data base
[PB80-815210] N81-12437
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440
Nondestructive testing information analysis center, 1979
[AD-A090718] N81-12442
Nondestructive testing of armament-system components by means of neutron diffraction
[AD-A090433] N81-12443
Development of nondestructive evaluation techniques for high-temperature ceramic heat exchanger components
[ANL/MSD/FE-80-4] N81-12617
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942

NONFLAMMABLE MATERIALS
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341

NONLINEAR EQUATIONS
Asymptotic behavior for a strongly damped nonlinear wave equation
[AD-A090548] N81-12814

NONLINEAR FILTERS
Optimal estimation of missile free-flight trajectory: Comparative results of linear and nonlinear Kalman filter approaches
[AD-A090717] N81-12144

NONLINEAR OPTICS
Surface nonlinear optics
[LBL-11252] N81-12875

NONLINEAR SYSTEMS
Nonlinear chi-square algorithm: An improvement on nonlinear least squares
[AD-A090420] N81-12792
Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801

NONPARAMETRIC STATISTICS
Nonparametric tests of independence for censored data
[AD-A090330] N81-12806

NONUNIFORM FLOW
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366

NONUNIFORM MAGNETIC FIELDS
Magnetic field directional discontinuities. 2: Characteristics between 0.46 and 1.0 AU --- interplanetary magnetic fields
[NASA-TM-82036] N81-12963

NORTH CAROLINA
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485

NORTH DAKOTA
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514

NORTHERN HEMISPHERE
Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685
The structure of air temperature fluctuations in the northern hemisphere, part 2.
[BLL-TRANS-1434-(9022.549)-PT-2] N81-12695

NOTCH STRENGTH
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456

NOTCH TESTS
Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456

NOVAE
An X-ray survey of nine historical novae --- HEAO 2 observations
[NASA-TM-82014] N81-12961

NOZZLE GEOMETRY
Acoustic transmission matrix of a variable area duct or nozzle carrying a compressible subsonic flow
[NASA-TM-81614] N81-12821

NUCLEAR CAPTURE
Studies of heavy ion reactions and transuranic nuclei
[COO-3496-75] N81-12841

NUCLEAR ELECTRIC POWER GENERATION
International energy indicators --- coal, crude oil, nuclear generation capacity petroleum products
[DOE/IA-0010/2] N81-12588
The magnetic fusion energy program: Its objectives and pace
[GPO-56-764] N81-12849

NUCLEAR FUELS
DYMAC digital electronic balance
[LA-8313-M] N81-12398
Proposed rulemaking on the storage and disposal of nuclear waste. Cross statement of the United States Department of Energy
[DOE/NE-0007-SUPPL-1] N81-12855

NUCLEAR FUSION
Neutral beam development plan
[DOE/ER-0075] N81-12856
Future prospects for gamma-ray
[NASA-TM-82041] N81-12959

NUCLEAR POWER PLANTS
Seismic response analysis for structures with non-orthogonal modes
[DP-MS/79-76] N81-12290

NUCLEAR RADIATION
Study of direct single photons and correlated particles in proton-proton collisions at radical s = 62.4 GeV
[DOE/ER-02232/90] N81-12840

NUCLEAR REACTIONS
Redefinition of the four fundamental forces
[AD-A090401] N81-12926

NUCLEAR REACTOR CONTROL
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783

NUCLEAR RESEARCH
Bag model, the hyperspherical formalism and the heavy baryons
[BNL-28198] N81-12836

NUCLEI (NUCLEAR PHYSICS)
Two-particle correlations in nuclear collisions
[LBL-11320] N81-12859

NULL ZONES
Antenna sidelobe and interference reduction. Citations from the NTIS data base
[PB80-815186] N81-12322

NUMBER THEORY
A historically motivated study of families of Pythagorean or Babylonian triples and their generating semigroups of p- or b-orthonormal matrices
[CTH-MATH-1980-3] N81-12815

NUMERICAL ANALYSIS
Numerical analysis of the flow in the connecting passage between the fan section and high pressure section of a turbojet engine
[AD-A090506] N81-12107
Turbulent solution of the Navier-Stokes equations
[NASA-TM-81621] N81-12358
Compact numerical method for the simulation of separated viscous flow, stationary or not. Application
[AAAF-NT-80-04] N81-12374
An algorithm module for abstract algebra
N81-12803
Computational physics program of the National MFE Computer Center
[UCID-175530-REV-1] N81-12927

NUMERICAL CONTROL
Propulsion control and control theory: A new research focus N81-12099
Open-loop heliostat reflector
[UCID-18764] N81-12587

NUMERICAL INTEGRATION
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12318

NUTATION DAMPERS
Method of and apparatus for damping nutation motion with minimum spin axis attitude disturbance
[NASA-CASE-GSC-12551-1] N81-12156

NUTRITION
Energy research and extension
[GPO-61-544] N81-12562

NYLON (TRADEMARK)
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425

NYQUIST DIAGRAM
Multivariable nyquest array method with application to turbofan engine control N81-12101

O

O RING SEALS
Modified spiral wound retaining ring
[NASA-CASE-LAR-12361-1] N81-12422

OCEAN CURRENTS
The dynamics of oceanic fronts. Part 1: The Gulf Stream
[NASA-TM-80335-PT-1] N81-12717

OCEAN SURFACE
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
Measurement of suspended solids in lakes and oceans using satellite remote sensing data
N81-12510
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703

OCEAN THERMAL ENERGY CONVERSION
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556
Ocean thermal energy conversion act of 1980
[GPO-64-551] N81-12565
Open cycle OTEC system with falling jet evaporator and condenser
[SERI/TP-631-791] N81-12573

OCEANOGRAPHIC PARAMETERS
NOSS flight segment concept study
[NASA-TM-82307] N81-12124
The Gulf Stream. Citations from the NTIS data base
[PB80-814098] N81-12718

OCEANS
Measurement of suspended solids in lakes and oceans using satellite remote sensing data
N81-12510
OFFSHORE PLATFORMS
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
OGIVES
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds
[AD-A090443] N81-12027
OIL EXPLORATION
Priority energy project act of 1979
[GPO-58-154] N81-12555
The Western Hemisphere energy system
[GPO-51-683] N81-12557
OIL RECOVERY
Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533
OILS
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
OKLAHOMA
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
ON-LINE PROGRAMMING
On-line information retrieval systems. Citations from the NTIS data base
[PB80-814841] N81-12934
ONBOARD EQUIPMENT
Development of hybrid circuits, a summary
[ESA-CR(P)-1243-REV-B] N81-12350
OPERATING SYSTEMS (COMPUTERS)
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
OPTICAL COMMUNICATION
Light communications Systems. Citations from the NTIS data base
[PB80-815301] N81-12321
Spatial coherence and intensity properties of quasihomogeneous optical sources
[AD-A090378] N81-12413
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
OPTICAL COUNTERMEASURES
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143
OPTICAL DATA PROCESSING
Fiber optic combiner and duplicator
[NASA-CR-160044] N81-12864
OPTICAL HETERODYNING
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 1
[NASA-CR-161611] N81-12697
OPTICAL MEASUREMENT
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386
Some results of preliminary tests on values of sky-sea contrast (visible horizon) as a function of environmental parameters
[ESA-TT-623] N81-12691
OPTICAL MEASURING INSTRUMENTS
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005
OPTICAL MEMORY (DATA STORAGE)
Holographic associative memories in document retrieval systems
[BMFT-FB-DV-79-05] N81-12931
OPTICAL PROPERTIES
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200
Flat plate solar collector design and performance. Citations from the NTIS data base
[PB80-814130] N81-12639
Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818
Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870
The use of optical techniques in the interpretation of heat transfer measurements N81-13007
OPTICAL PUMPING
Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407
Laser cooling and trapping of neutral atoms
[AD-A090760] N81-12408
Informal workshop on intense polarized ion sources: A summary
[ANL-80-73] N81-12854
OPTICAL RADAR
Spaceborne laser range and range rate finder
[ESA-CR(P)-1367] N81-12420
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
OPTICAL SLANT RANGE
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536
OPTICAL WAVEGUIDES
Nuclear radiation effects in fiber-optic waveguides
[AD-A090439] N81-12868
OPTIMAL CONTROL
Performance seeking controls N81-12092
Road map to adaptive optimal control --- jet engine control N81-12098
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide
[NASA-CR-152306] N81-12110
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778
OPTIMIZATION
Maximizing the intersection density of fiber processes
[CTH-MATH-1980-4] N81-12185
Aeroelastic optimization with multiple constraints
[AD-A090775] N81-12451
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
Flat plate solar collector design and performance. Citations from the Engineering Index data base
[PB80-814122] N81-12638
Vehicle systems design optimization study
[NASA-CR-163797] N81-12944
ORAL HYGIENE
Acoustic tooth cleaner
[NASA-CASE-LAR-12471-1] N81-12724
ORBIT PERTURBATION
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B
[RAE-TR-80052] N81-12693
ORBIT TRANSFER VEHICLES
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates
[NASA-CR-161608] N81-12161
ORDNANCE
Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260
Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287
OREGON
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
ORGANIC COMPOUNDS
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168
ORGANIC LIQUIDS
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200
ORGANIC MATERIALS
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
ORGANIZING
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
ORGANOMETALLIC COMPOUNDS
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912
ORIENTATION
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
ORTHONORMAL FUNCTIONS
A historically motivated study of families of Pythagorean or Babylonian triples and their generating semigroups of p- or b-orthonormal matrices
[CTH-MATH-1980-3] N81-12815
ORTHOTROPIC PLATES
OPTIM III: A NASTRAN compatible large scale automated minimum weight design problem. Users and programmers manual
[AD-A090334] N81-12458
OSCILLATION DAMPERS
Method of and apparatus for damping nutation motion with minimum spin axis attitude disturbance
[NASA-CASE-GSC-12551-1] N81-12156
OSCILLATIONS
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556
OUTCROPS
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508
OXIDATION
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
The vapor phase autoxidation of unsymmetrical dimethylhydrazine and 50 percent unsymmetrical dimethylhydrazine 50 percent hydrazine mixtures
[AD-A090281] N81-12261
The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569
OXIDATION RESISTANCE
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
OXIDATION-REDUCTION REACTIONS
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
OXYGEN
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915
OXYGEN PRODUCTION
Performance of the Scott Aviox emergency oxygen system after exposure to normal, hot and cold storage conditions
[AD-A090572] N81-12738
OXYGEN SUPPLY EQUIPMENT
Performance of the Scott Aviox emergency oxygen system after exposure to normal, hot and cold storage conditions
[AD-A090572] N81-12738
OZONE
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679

P

P-N JUNCTIONS
Development of high efficiency (14 percent) solar cell array module
[NASA-CR-163808] N81-12553

PACIFIC OCEAN
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703
PALMGREN-MINER RULE
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449
PANELS
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
PARABOLIC DIFFERENTIAL EQUATIONS
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12318
PARABOLIC REFLECTORS
Solar energy concentrator design and operation. Citations from the Engineering Index data base
[PB80-813934] N81-12642
PARACHUTE DESCENT
On parachutist dynamics
[AD-A090335] N81-12741
PARACHUTING INJURY
On parachutist dynamics
[AD-A090335] N81-12741
PARALLEL PROCESSING (COMPUTERS)
A special-purpose processor for an automatic feature extraction system
[AD-A090789] N81-12765
PARAMETER IDENTIFICATION
Multivariable identification using centralized fixed modes N81-12091
Parameter identification techniques for physiological control systems
[AD-A090547] N81-12728
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
PARAMETERIZATION
On eddy diffusion coefficients --- in atmospheric models
[AERONOMICA-ACTA-A-212-1980] N81-12672
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
Rigid muffin-tin approximation for the electron-phonon interaction in transition metals
[CONF-800864-1] N81-12839
PARAMETRIC AMPLIFIERS
Parametric acoustic conversion-efficiency enhancement via boundary induced and inherent dispersivity
[AD-A090329] N81-12823
PARTIAL DIFFERENTIAL EQUATIONS
Parameter identification techniques for physiological control systems
[AD-A090547] N81-12728
PARTICLE ACCELERATORS
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Beam-beam interactions for bunched and unbunched beams
[BNL-28186] N81-12852
PARTICLE COLLISIONS
Line shapes in laser experiments
[AD-A090766] N81-12415
Dynamics of reactions involving hydrogen atom or proton transfer symmetric case
[AD-A090588] N81-12830
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Multiple ionization and excitation processes in single ion-atom collisions
[CONF-800859-1] N81-12838
Collisional end losses from conventional and tandem mirrors
[SAI-254-80-442-LJ] N81-12892
Bumpy torus transport in the low collision frequency limit
[SAI-254-80-347-LJ] N81-12894
PARTICLE DENSITY (CONCENTRATION)
Turbulent mixing and concentration measurement
[VKI-PREPRINT-1980-8] N81-12377
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
PARTICLE ENERGY
Pulsar gamma-rays: Spectra luminosities and efficiencies
[NASA-TM-82026] N81-12962
PARTICLE INTERACTIONS
Dynamics of reactions involving hydrogen atom or proton transfer symmetric case
[AD-A090588] N81-12830
Two-particle correlations in nuclear collisions
[LBL-11320] N81-12859
Micom program in optical bistability
[AD-A090366] N81-12865
PARTICLE PRODUCTION
Search for direct photon production at Fermilab energies and comparison with direct photon measurements at IRS energies
[FERMILAB-CONF-79/85-EXP] N81-12843
PARTICLE SIZE DISTRIBUTION
Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411
An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653
Measuring particulate air pollution
[IG-PUBL-638] N81-12664
PARTICULATE SAMPLING
An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653
Measuring particulate air pollution
[IG-PUBL-638] N81-12664
PATTERN RECOGNITION
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Earth Observations Division version of the Laboratory for Applications of Remote Sensing System (EOD-LARSYS) user guide for the IBM 370/148. Volume 2: User reference manual
[E81-10010] N81-12487
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Remote sensing and image interpretation
[E81-10036] N81-12518
Contextual classification of multispectral image data: Approximate algorithm
[E81-10038] N81-12520
Two experiments on statistical image segmentation
[AD-A089484] N81-12764
Automatic scene analysis. Second contract report
[ENST-D-79024] N81-12776
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814239] N81-12784
Pattern recognition and image processing. Citations from the NTIS data base
[PB80-814221] N81-12785
PATTERN REGISTRATION
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
PAYLOAD DELIVERY (STS)
Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445
PELTIER EFFECTS
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
[DS-ERT-14/80] N81-12381
PENETRATION
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425
A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
Impulsive penetration of solar wind plasma and its effects on the upper atmosphere
[AERONOMICA-ACTA-A-207-1979] N81-12971
PENNSYLVANIA
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
PERCHLORATES
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
PERFORATED PLATES
Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467
PERFORMANCE PREDICTION
Engine diagnostics program: CF6-50 engine performance deterioration
[NASA-CR-159867] N81-12085
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192
Analytical investigation of critical phenomena in MHD power generators
[NASA-CR-165143] N81-12546
Solar total energy modularity study
[SAND-80-7060] N81-12608
PERFORMANCE TESTS
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068
Test track facilities --- military vehicles
[MVEE-MEMO-79021] N81-12122
The investigation into hydraulic gear pump efficiencies in the first few hours of the pumps' lives and a comparative study of accelerated life tests methods on hydraulic fluid power gear pumps, part 3
[AD-A089848] N81-12423
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444
Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653
Performance of the Scott Aviox emergency oxygen system after exposure to normal, hot and cold storage conditions
[AD-A090572] N81-12738
Computer storage management. Citations from NTIS data base
[PB80-814759] N81-12758
PERIPHERAL VISION
Peripheral cues and color in visual simulation
[AD-A089837] N81-12726
PERTURBATION THEORY
A phenomenological method of calculating microwave longitudinal coupling impedances
[BNL-51222] N81-12316
PETROLEUM PRODUCTS
International energy indicators --- coal, crude oil, nuclear generation capacity petroleum products
[DOE/IA-0010/2] N81-12588
PHANTOM AIRCRAFT
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
PHASE SHIFT
Antenna sidelobe and interference reduction. Citations from the NTIS data base
[PB80-815186] N81-12322
PHASE TRANSFORMATIONS
Photoemission from solids: The transition from solid-state to atomic physics
[LBL-11276] N81-12871
PHASED ARRAYS
Overlapped subarraying techniques
[AD-A089693] N81-12304
PHENOLIC RESINS
Phenolic resin syntactic foams
[BDX-613-2408] N81-12244

PHENOLOGY
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans — U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
PHENOMENOLOGY
A phenomenological method of calculating microwave longitudinal coupling impedances
[BNL-51222] N81-12316
PHOSPHATES
Large high quality single crystal aluminum phosphate for acoustic wave devices
[AD-A090359] N81-12905
PHOTOCHEMICAL REACTIONS
Solar cell utilizing photochemical generation of electricity
[DOE/R5-10114/1] N81-12581
PHOTOCONDUCTORS
The extension of (Hg, Cd)Te detector technology to the near millimeter spectral region
[AD-A090449] N81-12867
PHOTODECOMPOSITION
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
PHOTODIODES
Optical fibers and avalanche photodiodes for scintillator counters
[BNL-28195] N81-12876
PHOTOELECTRIC EMISSION
Solar cell utilizing photochemical generation of electricity
[DOE/R5-10114/1] N81-12581
Photoemission from solids: The transition from solid-state to atomic physics
[LBL-11276] N81-12871
PHOTOELECTRONS
Photoemission from solids: The transition from solid-state to atomic physics
[LBL-11276] N81-12871
PHOTOGEOLOGY
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission) — Yerington, Nevada mine area
[E81-10018] N81-12495
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500
PHOTOGRAMMETRY
Remote sensing and image interpretation
[E81-10036] N81-12518
PHOTOGRAPHIC MEASUREMENT
Two simple methods for deformation demonstration and measurement --- photographic techniques
[NLR-MP-80002-U] N81-12476
PHOTOGRAPHIC PLATES
Two simple methods for deformation demonstration and measurement --- photographic techniques
[NLR-MP-80002-U] N81-12476
PHOTOINTERPRETATION
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] *N81-12480*
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
Remote sensing and image interpretation
[E81-10036] N81-12518
A study of knowledge-based systems for photo *interpretation*
[AD-A090465] N81-12530
PHOTOLITHOGRAPHY
A study of trends and techniques for space base electronics
[NASA-CR-161277] N81-12327
PHOTOMASKS
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163806] N81-12549
PHOTOMICROGRAPHY
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722
PHOTON ABSORPTIOMETRY
Graphs of the cross sections in the Alternate Monte Carlo Cross Section library at the Los Alamos Scientific Laboratory
[LA-8394-MS] N81-12793
PHOTONEUTRONS
Graphs of the cross sections in the Alternate Monte Carlo Cross Section library at the Los Alamos Scientific Laboratory
[LA-8394-MS] N81-12793
PHOTONS
Study of direct single photons and correlated particles in proton-proton collisions at radical s = 62.4 GeV
[DOE/ER-02232/90] N81-12840
Search for direct photon production at Fermilab energies and comparison with direct photon measurements at IRS energies
[FERMILAB-CONF-79/85-EXP] N81-12843
PHOTONUCLEAR REACTIONS
Study of direct single photons and correlated particles in proton-proton collisions at radical s = 62.4 GeV
[DOE/ER-02232/90] N81-12840
Micom program in optical bistability
[AD-A090366] N81-12865
PHOTOSYNTHESIS
Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
PHOTOVOLTAIC CELLS
Miniature spectrally selective dosimeter
[NASA-CASE-LAR-12469-1] N81-12388
Contribution to the study of the internal mechanics of a space photovoltaic generator
[ESA-STR-205] N81-12631
The DOE photovoltaics program N81-12989
PHOTOVOLTAIC CONVERSION
Solar photovoltaics: Stand alone applications --- NASA Lewis Research Center research and development N81-12990
PHYSICAL OPTICS
Vector analogues of the Maggi-Rubinowicz theory of edge diffraction
[NASA-TM-82024] N81-12297
PHYSICAL PROPERTIES
Simultaneous measurement of multilayered composites
[BDX-613-2407] N81-12178
Evaluation of improved polyamides
[BDX-613-2354] N81-12241
PHYSIOLOGICAL EFFECTS
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667
Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720
XDC-2 digital decompression computer: Assessment of decompression profiles by ultrasonic monitoring, phase 1, 36-54 MSW
[AD-A090467] *N81-12729*
PHYSIOLOGICAL RESPONSES
Effect of ionizing radiations on connective tissue
[UR-3490-1900] *N81-12732*
PIEZOELECTRIC CRYSTALS
Large high quality single crystal aluminum phosphate *for acoustic wave devices*
[AD-A090359] N81-12905
Microstructure and domain structure of PZT --- *piezoelectric materials*
[LBL-10651] N81-12917
PIEZOELECTRIC TRANSDUCERS
Crack propagation and deformation in PZT *transducer ceramics*
[AD-A090569] N81-12234
PILOT ERROR
Aviation safety
[GPO-68-717] N81-12040
Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mohawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044
PILOT PERFORMANCE
Simulation comparison of a decoupled longitudinal control system and a velocity vector control wheel steering system during landings in wind shear
[NASA-TP-1734] N81-12109
Evaluation of Army aviator human factors, fatigue, in a high threat environment
[AD-A090751] N81-12730
Mathematical models of pilot-helicopter systems
[NLR-MP-79026-U] N81-12742
PILOT TRAINING
Flight test handbook: Flying qualities theory and flight test techniques
[AD-A090525] N81-12073
PINCH EFFECT
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Vector-potential flow in relativistic beam diodes
[NRL-MR-4326] N81-12857
PIPES (TUBES)
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556
PISTON ENGINES
The constant volume process in relation to the gas turbine as exemplified by the Karavodine engine
[WTHD-118] N81-12434
PITCH (INCLINATION)
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
PLANE WAVES
Fast deflagration waves
[AD-A090776] N81-12190
PLANETARY ATMOSPHERES
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964
Mars environment. Citations from the NTIS data base
[PB80-814999] N81-12970
PLANETARY COMPOSITION
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964
PLANETARY GEOLOGY
Significant achievements in the planetary geology program, 1980
[NASA-TM-82384] N81-12955
PLANETARY MAGNETIC FIELDS
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
Energetic particles in the pre-dawn magnetotail of Jupiter
[NASA-TM-81991] N81-12967
PLANETARY TEMPERATURE
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] *N81-12964*
PLANETARY WAVES
Planetary-wave behavior and arctic air pollution
[DOE/EV-01340/T2] *N81-12657*
PLANETOLOGY
Significant achievements in the planetary geology *program, 1980*
[NASA-TM-82384] N81-12955
PLANT STRESS
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, *Oregon*
[E81-10014] N81-12491
A study of Minnesota land and water resources using *remote sensing, volume 13*
[E81-10028] N81-12505
A project to evaluate moisture stress in corn and *soybean areas of western and southwestern* Minnesota N81-12509

PLANTS (BOTANY)
Proceedings of the International Workshop of the Effects of acid precipitation vegetation, soils, and terrestrial ecosystems
[BNL-51195] N81-12661
PLASMA ACCELERATION
Super-alfvenic propagation of cosmic rays: The role of streaming modes
[NASA-TM-82032] N81-12975
PLASMA CLOUDS
Initial assessment of the effects of energetic ion injections in the magnetosphere due to the transport of satellite power system components from low earth orbit to geosynchronous earth orbit
[NASA-TM-81982] N81-12682
PLASMA CONTROL
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
PLASMA DENSITY
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886
PLASMA DIAGNOSTICS
Spacecraft charging on ATS-5
[AD-A090508] N81-12147
PLASMA HEATING
Absorption of magnetoacoustic waves in a high beta plasma
[IPF-79-3] N81-12900
PLASMA INTERACTIONS
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12897
PLASMA PHYSICS
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889
Strongly-localized ballooning modes in a tandem mirror
[SAI-254-80-493-LJ] N81-12890
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891
Activities of the Space Science Department in 1978/1979
[ESA-SP-1032] N81-12992
PLASMA PINCH
A reactor study on a belt-shaped screw pinch --- configuration
[REPT-73-76] N81-12902
PLASMA PROPULSION
Mission integration study for solid Teflon pulsed plasma millipound propulsion system
[AD-A090514] N81-12162
PLASMA SHEATHS
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968
PLASMA WAVES
Wave propagation in a temperate plasma having n ions species
[IPF-78-7] N81-12899
PLASMA-PARTICLE INTERACTIONS
Beam-beam interactions for bunched and unbunched beams
[BNL-28186] N81-12852
PLASMAS (PHYSICS)
Pulse power switch development
[AD-A090511] N81-12339
Microchannel plate as a detector of minimum ionizing particle
[BNL-28279] N81-12845
Trapped electron modifications to tearing modes in the low collision frequency limit
[SAI-245-80-348-LJ] N81-12846
Analysis of proton transport experiments
[NRL-MR-4322] N81-12848
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873
The effects of electron-neutral collisions on the intensity of plasma lines
[AD-A090749] N81-12887
Collisional end losses from conventional and tandem mirrors
[SAI-254-80-442-LJ] N81-12892
Bumpy torus transport in the low collision frequency limit
[SAI-254-80-347-LJ] N81-12894
PLASMASPHERE
A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
PLASTIC DEFORMATION
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257
Two simple methods for deformation demonstration and measurement --- photographic techniques
[NLR-MP-80002-U] N81-12476
PLASTICS
Impact of modern materials on the development of rotating airfoil equipment
[AAAF-NT-79-43] N81-12182
Heat resistant plastics: Silicone, carborane, halocarbon, and other polymers. Citations from the NTIS data base
[PB80-814734] N81-12253
Heat resistant plastics: Nitrogen containing polymers. Citations from the NTIS data base
[PB80-814742] N81-12254
Laser cutting plastic materials
[BDX-613-2476] N81-12417
PLATEAUS
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
PLATES (TECTONICS)
Crustal dynamics project observing plan for highly mobile systems 1981 - 1986
[NASA-TM-82029] N81-12680
PLOTTERS
Guidelines in preparing computer-generated plots for NASA technical reports with the LRC graphics output system
[NASA-TM-81908] N81-12761
PLUMES
Tracking of smokestack and cooling tower plumes using wind measurements at different levels
[ORNL/TM-7417] N81-12654
PNEUMONIA
Mechanisms of recombination and function of DNA in bacteria
[DOE/EV-03941/52] N81-12721
POISSON DENSITY FUNCTIONS
Maxwell-Vlasov equations as a continuous Hamiltonian system
[PPPL-1702] N81-12797
POLARIZATION (CHARGE SEPARATION)
Informal workshop on intense polarized ion sources: A summary
[ANL-80-73] N81-12854
POLARIZATION (WAVES)
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387
POLICIES
Oversight hearing: United States Metric Board
[GPO-56-236] N81-12284
The foundations of United States information policy
[PB80-204019] N81-12933
United States civilian space policy
[GPO-66-883] N81-12941
POLLUTION CONTROL
Aircraft towing feasibility study
[DOE/CS-50069/1] N81-12051
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
Report to the National Commission of Air Quality on the benefit methodology evaluation panel
[PB80-208390] N81-12668
POLLUTION MONITORING
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4
[DOE/RG-10075/T1] N81-12269
DYMAC digital electronic balance
[LA-8313-M] N81-12398
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
Air quality monitoring. Citations from the NTIS data base
[PB80-813462] N81-12665
Air quality monitoring. Citations from the NTIS data base
[PB80-813470] N81-12666
POLYAMIDE RESINS
Evaluation of improved polyamides
[BDX-613-2354] N81-12241
POLYBENZIMIDAZOLE
Heat resistant plastics: Nitrogen containing polymers. Citations from the NTIS data base
[PB80-814742] N81-12254
POLYBUTADIENE
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
Properties of some diblock copolymers based on 1,3 butadiene monomer
[AD-A090144] N81-12230
POLYCRYSTALS
Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870
POLYETHYLENES
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236
POLYIMIDE RESINS
Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
POLYIMIDES
Phenolic resin syntactic foams
[BDX-613-2408] N81-12244
POLYMER MATRIX COMPOSITE MATERIALS
Self-lubricating composite materials N81-12984
POLYMER PHYSICS
Properties of some diblock copolymers based on 1,3 butadiene monomer
[AD-A090144] N81-12230
POLYMERIZATION
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
POLYMERS
Test methods for the dynamic mechanical properties of polymeric materials
[BDX-613-2405] N81-12246
POLYPHENYLS
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C --- air breathing engines
[NASA-CR-159794] N81-12227
POLYQUINOXALINES
Heat resistant plastics: Nitrogen containing polymers. Citations from the NTIS data base
[PB80-814742] N81-12254
POLYSTYRENE
Moisture penetration evaluation of polystyrene bead foam as an encapsulant for electronic packages
[BDX-613-2394] N81-12245
POLYURETHANE FOAM
Development of a new polyurea foam insulation material
[EUR-6737-EN] N81-12235
POLYURETHANE RESINS
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
PORTABLE EQUIPMENT
Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401
POSITION (LOCATION)
Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060
Army GPS-doppler hybrid navigation system
[AD-A090394] N81-12062
POSITION ERRORS
Satellite pointing errors and their statistics
[ESS/SS-957] N81-12152

POTASSIUM
MHD heat and seed recovery technology project
[ANL/MHD-80-1] N81-12898
POTASSIUM IODIDES
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
POTENTIAL ENERGY
Experimental and theoretical study of thermal performance of a hybrid solar system at LIving History Farms
[DOE/CS-34136/1] N81-12606
Electronic excitation in molecular collisions structural dynamic and kinetic considerations
[AD-A090287] N81-12833
POTENTIAL FLOW
Vector-potential flow in relativistic beam diodes
[NRL-MR-4326] N81-12857
POTENTIAL THEORY
Multigrid technique applied to lifting transonic flow using full potential equation
[SAAB-L-0-1-B439] N81-12028
Redefinition of the four fundamental forces
[AD-A090401] N81-12926
POWDER METALLURGY
A15 multifilamentary superconductors by the infiltration process
[LBL-10761] N81-12342
POWER CONDITIONING
Laser satellite power systems
[ANL/ES-92] N81-12592
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987
POWER PLANTS
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
POWER SUPPLY CIRCUITS
Three phase power factor controller
[NASA-CASE-MFS-25535-1] N81-12330
PRECIPITATION (METEOROLOGY)
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
PREDICTION ANALYSIS TECHNIQUES
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
The 1980 status report on low-level, atmospheric turbulence model for marine environments
[AD-A090576] N81-12701
Finite element analysis of crack growth
[NLR-MP-78017-U] N81-12802
PREDICTIONS
Unsteady aerodynamics inputs for aeroelastic analyses. Part A: A general introduction. Part B: Prediction of the unsteady airloads on oscillating lifting systems and bodies in subsonic and supersonic flow
[DFVLR-MITT-80-01] N81-12035
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
Production of nitrous oxide in a rocket motor exhaust
[PERME-MEMO-96] N81-12167
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
PREMIXED FLAMES
Velocity and temperature measurements in a premixed flame within an axisymmetric combustor N81-13006
PRESIDENTIAL REPORTS
Aeronautics and Space Report of the President, 1979 activities N81-12956
PRESSURE DISTRIBUTION
System to measure the pressure distribution on fan aerofoil surfaces during flutter conditions
[PNR-90013] N81-12029
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12318
Effect of rawinsonde errors on rocketsonde density and pressure profiles: An error analysis of the Rawinsonde System
[NASA-CR-156873] N81-12677
PRESSURE EFFECTS
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444
PRESSURE GAGES
Water vapor pressure gauge --- vacuum systems apparatus
[BNL-28267] N81-12399
PRESSURE GRADIENTS
Experimental analysis of the boundary layer transition with zero and positive pressure gradient
[NASA-TM-75763] N81-12359
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
PRESSURE MEASUREMENTS
Probe measurements in multi-dimensional reacting flows N81-12997
PRESSURE OSCILLATIONS
Noise measurements and the dB --- errors
[RAE-TM-FS-348] N81-12827
PRESSURE REDUCTION
Application of model laws when determining the heat transfer coefficients by experiments on cooled turbine blades N81-12998
PRESSURE SENSORS
System to measure the pressure distribution on fan aerofoil surfaces during flutter conditions
[PNR-90013] N81-12029
PRESSURE VESSELS
Pressure vessels for coal liquefaction: An overview
[IS-M-282] N81-12429
PRINTED CIRCUITS
The MSFC silicon gate silicon-on-sapphire standard cell library
[NASA-TM-78194] N81-12324
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
PRINTED RESISTORS
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163806] N81-12549
PRISMS
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387
PROBABILITY DENSITY FUNCTIONS
Satellite pointing errors and their statistics
[ESS/SS-957] N81-12152
PROBES
Probe measurements in multi-dimensional reacting flows N81-12997
PROBLEM SOLVING
Solving the Heimholtz equation for exterior problems with variables index of refraction, 1
[AD-A090550] N81-12309
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891
PROCESS CONTROL (INDUSTRY)
Support studies in fluidized-bed combustion
[ANL/CEN/FE-79-14] N81-12280
PROCESS HEAT
Coal gasifier cogeneration powerplant project N81-12988
PRODUCT DEVELOPMENT
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054
Tactical video display
[AD-A089992] N81-12302
Pulse power switch development
[AD-A090511] N81-12339
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
Development of an electrophoretic image display
[AD-A090574] N81-12396
Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554
Low cost thin film polycrystalline silicon solar cells
[DOE/ET-23048/T1] N81-12603
Flat plate solar collector design and performance. Citations from the Engineering Index data base
[PB80-814122] N81-12638
Multipurpose reconfigurable simulator --- computers multiprocessing
[ESS/SS-983] N81-12754
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
Fiber optic combiner and duplicator
[NASA-CR-160044] N81-12864
PRODUCTION COSTS
Overall requirements for an advanced underground coal extraction system --- environment effects, miner health and safety, production cost, and coal conservation
[NASA-CR-163748] N81-12523
Solar silicon via the Dow Corning process
[NASA-CR-163798] N81-12551
Sequential purification and crystal growth for the production of low cost silicon substrates
[DOE/SERI/8229-3/2-T6] N81-12602
PRODUCTION ENGINEERING
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates
[NASA-CR-161608] N81-12161
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
Laser applications
[BDX-613-2448] N81-12418
Production technology of beta-alumina ceramics for Na/S batteries
[BMFT-FB-T-79-57] N81-12629
Solar-augmented applications in industry
[PB80-205313] N81-12643
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925
PRODUCTION MANAGEMENT
Deburring: Technical capabilities and cost-effective approaches, lessons 5 and 6
[BDX-613-2382] N81-12288
International energy indicators --- coal, crude oil, nuclear generation capacity petroleum products
[DOE/IA-0010/2] N81-12588
PROGRAM VERIFICATION (COMPUTERS)
Software test models and implementation of associated test drivers
[AD-A089997] N81-12763
A comparative analysis of functional correctness
[AD-A090487] N81-12767
Graph theory leads to program visibility --- computer program integrity
[RSRE-80004] N81-12771
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
PROGRAMMERS
Comparison of and conversion between different implementations of the FORTRAN programming language
[NASA-TM-81995] N81-12762
PROGRAMMING LANGUAGES
Honeywell information systems, COBOLA 2.0, level 6, MOD 0400 COBOL compiler
[PB80-204969] N81-12759
An integrated methodology and tools for software development
[AD-A090347] N81-12766
Reference manual for the ADA programming language, proposed standard document
[AD-A090709] N81-12768
Programming language design. Citations from the NTIS data base
[PB80-814767] N81-12773
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777

PROJECT MANAGEMENT
DOD-DOE Workshop on Joint Energy Activities [CONF-800383] N81-12590
PROJECTILES
Spin jet damping of rocket-assisted projectiles [AD-A089980] N81-12142
Proceedings of the Army symposium on solid mechanics. Designing for extremes: Environment, Loading, and Structural Behavior [AD-A090684] N81-12285
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration [AD-A090341] N81-12425
PROJECTIVE GEOMETRY
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection [NASA-TM-81998] N81-12528
PROPELLANT GRAINS
Three dimensional finite element combustion instability analysis [AD-A090396] N81-12194
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant [AD-A090356] N81-12256
PROPELLANTS
Recommended hazard classification procedures for in process propellant and explosive material [AD-A090674] N81-12260
PROPORTION
As-built design specification for proportion estimate software subsystem [E81-10002] N81-12479
PROPORTIONAL CONTROL
Error analysis of pursuit and proportional navigation control laws [AD-A090155] N81-12056
PROPULSION SYSTEM CONFIGURATIONS
NASA Research in aeropropulsion N81-12980
Progress in materials and structures at Lewis Research Center N81-12982
Propulsion system research and development for electric and hybrid vehicles N81-12985
PROPULSION SYSTEM PERFORMANCE
Propulsion Controls, 1979 --- air breathing engine control [NASA-CP-2137] N81-12090
Performance seeking controls N81-12092
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
Design of a multivariable integrated control for a supersonic propulsion system --- variable stream control engine N81-12094
Propulsion controls N81-12095
Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096
Impact for the 80's: Proceedings of a Conference on Selected Technology for Business and Industry [NASA-CP-2149] N81-12978
JPL's electric and hybrid vehicles project: Project activities and preliminary test results --- power conditioning and battery charge efficiency N81-12987
PROTECTIVE CLOTHING
Anthropometry: Basic studies and applications. Citations from the NTIS data base [PB80-813645] N81-12736
PROTECTIVE COATINGS
Curved film cooling admission tube [NASA-CASE-LEW-13174-1] N81-12363
Flat plate solar collector design and performance. Citations from the NTIS data base [PB80-814130] N81-12639
Thin-film coatings N81-12983
PROTON BEAMS
Analysis of proton transport experiments [NRL-MR-4322] N81-12848
PROTON ENERGY
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors [NASA-CR-160037] N81-12175
PROTON-PROTON REACTIONS
Study of direct single photons and correlated particles in proton-proton collisions at radical s = 62.4 GeV [DOE/ER-02232/90] N81-12840
PROTONS
Dynamics of reactions involving hydrogen atom or proton transfer symmetric case [AD-A090588] N81-12830
Two-particle correlations in nuclear collisions [LBL-11320] N81-12859
PSYCHOMETRICS
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech [RAE-TM-FS-334] N81-12737
PUBLIC HEALTH
Clean air act-amendments of 1977: Oversight [GPO-63-136] N81-12648
PUBLIC LAW
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings [GPO-57-523] N81-12583
PULSARS
Pulsar gamma-rays: Spectra luminosities and efficiencies [NASA-TM-82026] N81-12962
PULSE MODULATION
Pulse code modulation of CO2 tea laser pulse [AD-A090436] N81-12412
PULSED LASERS
High accuracy distance measurement by two-wavelength pulsed laser source [CISE-N-189] N81-12419
PUMPS
The investigation into hydraulic gear pump efficiencies in the first few hours of the pumps' lives and a comparative study of accelerated life tests methods on hydraulic fluid power gear pumps, part 3 [AD-A089848] N81-12423
PURIFICATION
Sequential purification and crystal growth for the production of low cost silicon substrates [DOE/SERI/8229-3/2-T6] N81-12602
PURSUIT TRACKING
Error analysis of pursuit and proportional navigation control laws [AD-A090155] N81-12056
PYROELECTRICITY
Pyroelectric detector arrays [NASA-CASE-LAR-12363-1] N81-12389
PYROLYSIS
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor [SERI/TR-332-586] N81-12196
The flash hydrogenation of biomass [BNL-28297] N81-12277
PYROPHORIC MATERIALS
Recommended hazard classification procedures for in process propellant and explosive material [AD-A090674] N81-12260

Q

QUADRATIC EQUATIONS
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection [NASA-TM-81998] N81-12528
QUALITY CONTROL
Flammability testing --- aerospace materials [ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
Acoustic emission of carbon fiber reinforced plastics [FOK-R-2464] N81-12250
Nondestructive testing of armament-system components by means of neutron diffraction [AD-A090433] N81-12443
QUANTITATIVE ANALYSIS
The application of UV spectroscopy to the qualitative analysis of nitrogen oxide N81-13008
QUANTUM MECHANICS
Redefinition of the four fundamental forces [AD-A090401] N81-12926
QUANTUM THEORY
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference [LBL-9501-VOL-2] N81-12835
Study of direct single photons and correlated particles in proton-proton collisions at radical s = 62.4 GeV [DOE/ER-02232/90] N81-12840
QUARKS
Bag model, the hyperspherical formalism and the heavy baryons [BNL-28198] N81-12836
QUARTZ
Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields [AD-A090361] N81-12332
QUARTZ CRYSTALS
Investigation into the sensitive parameters in a quartz oscillator [ESA-TT-636] N81-12352
QUASARS
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227 [NASA-TM-82037] N81-12974
QUATERNIONS
A characterization of Gorenstein orders in quaternion algebras [CTH-MATH-1980-6] N81-12816
QUENCHING (COOLING)
HC quench layer formation in combustion processes [DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes [DOE/ET-15303/T3] N81-12199
QUEUEING THEORY
Algorithmic solution of some queues with overflows [AD-A090771] N81-12779
Optimal resource placement in a distributed system (extended abstract) [AD-A090772] N81-12780
QUIET ENGINE PROGRAM
Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) --- Lewis 9 by 15 foot low speed wind tunnel tests [NASA-TP-1178] N81-12084

R

RADAR EQUIPMENT
Acoustoelectric devices: A new technology for waveform-agile radar [AD-A090645] N81-12311
RADAR RANGE
Improved methods for computing drag corrected missile impact predictions in real time [AD-A090413] N81-12145
RADAR SCANNING
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites [NASA-TM-82011] N81-12296
Efficient multipliers for the FFT [AD-A090648] N81-12789
RADAR SCATTERING
Theoretical and experimental study of radar scattering and simulation. Part 1: Theory [AD-A090500] N81-12310
RADAR TARGETS
A new technique for Doppler frequency analysis of radar signals [AD-A090435] N81-12314
RADAR TRACKING
Frequency diverse tracking/guidance millimeter radar adapted to target acquisition [AD-A090355] N81-12305
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B [RAE-TR-80052] N81-12693
RADIATION ABSORPTION
Laser fusion studies at NRL [AD-A090116] N81-12850
RADIATION BELTS
Reduction and analysis of ATS-6 data [NASA-CR-160052] N81-12683
RADIATION COUNTERS
Microchannel plate as a detector of minimum ionizing particle [BNL-28279] N81-12845
RADIATION DAMAGE
The CISE tandem vandeGraaf accelerator and its fields of use [CISE-N-191] N81-12820

RADIATION DETECTORS
Miniature spectrally selective dosimeter
[NASA-CASE-LAR-12469-1] N81-12388
The extension of (Hg, Cd)Te detector technology to the near millimeter spectral region
[AD-A090449] N81-12867
RADIATION DOSAGE
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731
Evaluation of several methods for assessing the effects of occupational exposure to radiation
[PNL-SA-8438] N81-12733
RADIATION EFFECTS
Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720
Effect of ionizing radiations on connective tissue
[UR-3490-1900] N81-12732
Evaluation of several methods for assessing the effects of occupational exposure to radiation
[PNL-SA-8438] N81-12733
Theoretical studies relating to the interaction of radiation with matter: Atomic collision processes occurring in the presence of radiation fields
[AD-A090528] N81-12832
RADIATION HARDENING
Nuclear radiation effects in fiber-optic waveguides
[AD-A090439] N81-12868
RADIATION HAZARDS
Miniature spectrally selective dosimeter
[NASA-CASE-LAR-12469-1] N81-12388
RADIATION MEASUREMENT
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
Observation of the solar ultraviolet radiation
[AERONOMICA-ACTA-A-211-1980] N81-12972
RADIATION MEASURING INSTRUMENTS
BIRAMIS: Numerical evaluation of the overall system precision --- radiation balance measurements by satellite-borne microaccelerometer
[ONERA-RT-7/3373-SY] N81-12159
RADIATION PRESSURE
Laser cooling and trapping of neutral atoms
[AD-A090760] N81-12408
RADIATION SOURCES
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722
RADIATION TOLERANCE
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
RADIATIVE HEAT TRANSFER
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
Measurement of the solar radiative properties of silica gel
[VKI-TM-29] N81-12635
RADIATIVE TRANSFER
Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body
[NASA-CR-163795] N81-12140
RADIO ASTRONOMY
The formation of arcs in the dynamic spectra of Jovian decameter bursts
[NASA-TM-81987] N81-12966
RADIO BURSTS
The formation of arcs in the dynamic spectra of Jovian decameter bursts
[NASA-TM-81987] N81-12966
RADIO FREQUENCY HEATING
Conveyorized radio frequency cure of epoxy glass composites
[AD-A089728] N81-12176
RADIO FREQUENCY INTERFERENCE
Coding and processing for reliable data transmission
[AD-A090406] N81-12315
RADIO RECEIVERS
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054
RADIO RECEPTION
Coding and processing for reliable data transmission
[AD-A090406] N81-12315
RADIO TRANSMISSION
The multiple stack algorithm implemented on a Zilog Z-80 microcomputer
[AD-A090606] N81-12791
RADIOACTIVE WASTES
Proposed rulemaking on the storage and disposal of nuclear waste. Cross statement of the United States Department of Energy
[DOE/NE-0007-SUPPL-1] N81-12855
State-of-the-art report on low-level radioactive waste treatment
[ORNL/TM-7427] N81-12858
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
The APEX accelerator cycle for transmutation of long-lived fission wastes
[BNL-28282] N81-12861
RADIOMETERS
AVHRR/1-FM Advanced Very High Resolution Radiometer
[NASA-CR-160059] N81-12392
RAMAN SPECTRA
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
RAMAN SPECTROSCOPY
Diagnosing combustion by D.R.A.S.C. --- coherent anti-Stokes Raman spectroscopy N81-13009
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
RAMJET ENGINES
Effects of advances in propulsion technology on missile effectiveness --- solid fuel ramjets
[AD-A090645] N81-12106
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192
RANDOM ACCESS MEMORY
The design and implementation of the memory manager for a secure archival storage system
[AD-A090313] N81-12749
RANDOM NUMBERS
In search of correlation in multiplicative congruential generators with modulus (2 to the 31st power) minus 1
[AD-A090636] N81-12808
RANDOM SAMPLING
In search of correlation in multiplicative congruential generators with modulus (2 to the 31st power) minus 1
[AD-A090636] N81-12808
RANDOM VARIABLES
On a general asymptotic independence: Result in statistics, a preliminary report
[SAAB-FTK-0-79-22] N81-12804
On limiting distributions of intermediate order statistics from stationary sequences
[AD-A090617] N81-12809
RANGE AND RANGE RATE TRACKING
Spaceborne laser range and range rate finder
[ESA-CR(P)-1367] N81-12420
RANGE SAFETY
Improved methods for computing drag corrected missile impact predictions in real time
[AD-A090413] N81-12145
RANGEFINDING
Pulse code modulation of CO2 tea laser pulse
[AD-A090436] N81-12412
RARE EARTH ALLOYS
Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818
RARE GASES
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831
RATES (PER TIME)
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885
RAWINSONDES
Effect of rawinsonde errors on rocketsonde density and pressure profiles: An error analysis of the Rawinsonde System
[NASA-CR-156873] N81-12677
RAYLEIGH WAVES
Nonlinear magnetohydrodynamics
[ORO-5260-4] N81-12896
REACTION KINETICS
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197
The vapor phase autoxidation of unsymmetrical dimethylhydrazine and 50 percent unsymmetrical dimethylhydrazine 50 percent hydrazine mixtures
[AD-A090281] N81-12261
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263
A reaction mechanism in the shock initiation of detonation: A theoretical study
[AD-A090357] N81-12264
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
REACTIVITY
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
REACTOR CORES
Determination of coefficients for the universal laws of friction and heat transfer for CFTL calculations --- reactor core flow
[ORNL/TM-7418] N81-12819
REACTOR PHYSICS
Determination of coefficients for the universal laws of friction and heat transfer for CFTL calculations --- reactor core flow
[ORNL/TM-7418] N81-12819
REACTOR TECHNOLOGY
Mechanisms and kinetics of coal hydrogenation
[DOE/ET-14881/2] N81-12273
REAL TIME OPERATION
POSER: A Process Organization to Simplify Error Recovery --- fault tolerant real time computer systems
[RSRE-MEMO-3249] N81-12772
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777
RECONNAISSANCE AIRCRAFT
Performance of the Scott Aviox emergency oxygen system after exposure to normal, hot and cold storage conditions
[AD-A090572] N81-12738
RECTANGULAR WINGS
Evaluation of Levinsky's method for the calculation of the lift distribution on a wing in propulsive jets
[NLR-TR-77104-U] N81-12033
RECTENNAS
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
RECURSIVE FUNCTIONS
Improved recursive formula for calculating shock response spectra
[SAND-80-1315C] N81-12367
REDUCTION (CHEMISTRY)
Surface and catalysis science in the Materials and Molecular Research Division
[DOE/TIC-11225] N81-12202
The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569
REDUNDANCY
Failure detection system design methodology
[NASA-CR-163792] N81-12439
An overview of reliable computer system design
[RSRE-80003] N81-12775
REENTRY SHIELDING
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154
REENTRY TRAJECTORIES
Station control and the orbit of Skylab during the period April 1978 to July 1979
[VTH-LR-288] N81-12131
REENTRY VEHICLES
Interlevel correlations of temperature and density, surface to 60 km
[AD-A090515] N81-12130
AMARV high reliability piece part
[AD-A090577] N81-12441

REFINING
Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268
REFLECTANCE
Development of a second generation portable specular reflectometer
[SAND-80-1509C] N81-12402
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
REFLECTOMETERS
Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401
Development of a second generation portable specular reflectometer
[SAND-80-1509C] N81-12402
REFRACTED WAVES
Solving the Helmholtz equation for exterior problems with variables index of refraction, 1
[AD-A090550] N81-12309
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889
REFRACTION
Interferometric measurement of small refraction angles
[AD-A090594] N81-12889
REFRACTORY MATERIALS
Inert gas welding. Citations from the NTIS data base
[PB80-815210] N81-12437
REFRACTORY METAL ALLOYS
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
REFRACTORY METALS
Electrotransport of solutes in refractory metals
[IS-4722] N81-12218
REFRIGERANTS
Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157
REGENERATION (ENGINEERING)
Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203
REGENERATORS
Heat recovery devices, new
[PB80-205438] N81-12384
REGISTERS (COMPUTERS)
Design, development, fabrication and delivery of register and multiplexer units --- CMOS monolithic chip development
[NASA-CR-150801] N81-12746
REGRESSION ANALYSIS
Applications of efficient subset selection to digital filtering and to signal resolution
[AD-A090128] N81-12813
REGULATIONS
Summary of the midwest conference on small-scale hydropower in the midwest: An old technology whose time has come --- federal and state regulatory burdens and the economic market
[DOE/RA-04934/05] N81-12611
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645
REINFORCING FIBERS
Laminates and reinforced metals
[NASA-TM-81591] N81-12171
RELATIVISTIC ELECTRON BEAMS
Vector-potential flow in relativistic beam diodes
[NRL-MR-4326] N81-12857
RELATIVISTIC PLASMAS
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922
RELAXATION (MECHANICS)
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912
RELAXATION METHOD (MATHEMATICS)
Multigrid technique applied to lifting transonic flow using full potential equation
[SAAB-L-0-1-B439] N81-12028
RELEASING
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883
RELIABILITY
Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070
An overview of reliable computer system design
[RSRE-80003] N81-12775
RELIABILITY ANALYSIS
Reliability, energy, and cost effects of wind powered generation integrated with a conventional generating system
[ANL/AA-17] N81-12621
On a general asymptotic independence: Result in statistics, a preliminary report
[SAAB-FTK-0-79-22] N81-12804
RELIABILITY ENGINEERING
The changing scene of structural airworthiness
[AAAF-NT-79-24] N81-12076
Reliable software: Standards for the production of high quality systems --- esa satellites
[ESA-CR(P)-1358] N81-12770
REMOTE SENSORS
Swedish space activities during 1979 N81-12125
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
Theoretical and experimental study of radar scattering and simulation. Part 1: Theory
[AD-A090500] N81-12310
Remote sensing and image interpretation
[E81-10036] N81-12518
A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
[NASA-TM-82019] N81-12526
Remote Sensing For Water Resources And Hydrology. Recommended research emphasis for the 1980's
[NASA-CR-163791] N81-12529
Remote sensing of agricultural resources. Citations from the NTIS data base
[PB80-814981] N81-12541
The Gulf Stream. Citations from the NTIS data base
[PB80-814098] N81-12718
REMOTELY PILOTED VEHICLES
Closed loop control systems: Aircraft. Citations from the NTIS data base
[PB80-813710] N81-12114
REPLACING
On the decision to replace a unit early or late: A graphical solution
[SAAB-FTK-0-79-19] N81-12438
REQUIREMENTS
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380
RESEARCH
Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233
RESEARCH AND DEVELOPMENT
Solar energy in Australia: A profile of renewable energy activity in its national context
[SERI/SP-763] N81-12578
Research and technology of the Langley Research Center
[NASA-TM-81910] N81-12977
The DOE photovoltaics program N81-12989
RESEARCH FACILITIES
Space activities in Finland in 1979 N81-12126
French space programs for 1979 N81-12127
Research and technology of the Langley Research Center
[NASA-TM-81910] N81-12977
RESEARCH MANAGEMENT
French space programs for 1979 N81-12127
Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287
A strategic cost-benefit analysis of energy policies: Overview
[BNL-51105] N81-12612
RESERVOIRS
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
RESIDENTIAL ENERGY
Heat recovery devices, new
[PB80-205438] N81-12384
Solar hot water space heating system
[DOE/CS-34412/18] N81-12584
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
RESIDUAL STRESS
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
RESIN BONDING
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226
RESONANCE
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
RESONANT FREQUENCIES
The effects of electron-neutral collisions on the intensity of plasma lines
[AD-A090749] N81-12887
Diagnosing combustion by D.R.A.S.C. --- coherent anti-Stokes Raman spectroscopy N81-13009
RESONATORS
Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields
[AD-A090361] N81-12332
RESOURCE ALLOCATION
Economic analysis procedures for ADP
[AD-A089826] N81-12936
RESOURCES MANAGEMENT
A digital systematic classification of ecosystems with an illustrated summary of the natural vegetation of North America
[PB80-194020] N81-12532
Remote sensing of agricultural resources. Citations from the NTIS data base
[PB80-814981] N81-12541
RESPIRATION
Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719
RESPIRATORY PHYSIOLOGY
Parameter identification techniques for physiological control systems
[AD-A090547] N81-12728
Hyperbaric oxygenation. Citations from the NTIS data base
[PB80-813769] N81-12735
RETAINING
Modified spiral wound retaining ring
[NASA-CASE-LAR-12361-1] N81-12422
RETROFITTING
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
REUSABLE HEAT SHIELDING
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154
REVERSED FLOW
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433
REYNOLDS NUMBER
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719

RHENIUM
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923

RICE
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480

RING LASERS
Ring laser gyro
[AD-A090643] N81-12395

RING STRUCTURES
Modified spiral wound retaining ring
[NASA-CASE-LAR-12361-1] N81-12422

RIVER BASINS
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506

RIVERS
Measurement of suspended solids in lakes and oceans using satellite remote sensing data
N81-12510

RIVETED JOINTS
Application of fracture mechanics to built-up structures --- aircraft handbooks
[NLR-MP-79044-U] N81-12475

ROBOTS
Automatic scene analysis. Second contract report
[ENST-D-79024] N81-12776

ROCKET ENGINES
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates
[NASA-CR-161608] N81-12161
IRIS derived rocket (IDR) to be used as Ariane 4th stage
[ESA-CR(P)-1370] N81-12166

ROCKET EXHAUST
Production of nitrous oxide in a rocket motor exhaust
[PERME-MEMO-96] N81-12167

ROCKET PROPELLANTS
Burning rate transitions for HMX burned as a binderless propellant
[AD-A090389] N81-12258

ROCKET SOUNDING
Swedish space activities during 1979 N81-12125
Effect of rawinsonde errors on rocketsonde density and pressure profiles: An error analysis of the Rawinsonde System
[NASA-CR-156873] N81-12677

ROCKET THRUST
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142

ROLLER BEARINGS
Advanced transmission components investigation program: Bearing and seal development
[AD-A090675] N81-12075

ROLLING CONTACT LOADS
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226

ROTARY WINGS
Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074
Transonic rotor noise - theoretical and experimental comparisons
[AD-A090806] N81-12824

ROTATING LIQUIDS
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433

ROTATING SPHERES
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123

ROTOR AERODYNAMICS
The effects of solidity, interblade phase angle and reduced frequency on the time-variant aerodynamic response of a compressor stator
[AD-A090546] N81-12108

ROTOR BLADES
Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070

RUBBER
Morphology and phase composition of an amine cured rubber modified epoxy
[SAND-80-1914C] N81-12242

RUBIDIUM COMPOUNDS
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923

RUTHENIUM COMPOUNDS
Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924

S

S MATRIX THEORY
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference
[LBL-9501-VOL-2] N81-12835

S-N DIAGRAMS
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449

S-61 HELICOPTER
Aircraft accident report: New York Airways, Inc., Sikorsky S61-L, N618PA Newark, New Jersey, April 18, 1979
[NTSB-AAR-79-14] N81-12045

SAFETY DEVICES
Anthropometry: Basic studies and applications. Citations from the NTIS data base
[PB80-813645] N81-12736

SAFETY FACTORS
Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260

SAGE SATELLITE
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675

SALINITY
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
The Gulf Stream. Citations from the NTIS data base
[PB80-814098] N81-12718

SAMPLERS
An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653

SANDWICH STRUCTURES
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
Investigation of impact damage in sandwich panels with face sheets of composite materials
[NLR-TR-79011-U] N81-12187
Application of fracture mechanics to built-up structures --- aircraft handbooks
[NLR-MP-79044-U] N81-12475

SATELLITE ATTITUDE CONTROL
Satellite pointing errors and their statistics
[ESS/SS-957] N81-12152
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164

SATELLITE CONFIGURATIONS
Spacecraft structural acoustic studies. Investigation, interpretation, and simulation of the effects of configuration features on noise. Induced structural vibration and sound transmission characteristics
[BAE-ESA/B44/40013] N81-12472

SATELLITE CONTROL
Mission integration study for solid Teflon pulsed plasma millipound propulsion system
[AD-A090514] N81-12162

SATELLITE DESIGN
NOSS flight segment concept study
[NASA-TM-82307] N81-12124
Proposals to use micro-accelerometers for space geodetic experiments
[ESA-CR(P)-1371] N81-12160
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184

SATELLITE INSTRUMENTS
Design studies for a far infrared absolute spectrometer for the cosmic background explorer
[NASA-CR-160051] N81-12385

SATELLITE OBSERVATION
Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection --- detecting aircraft from satellites
[AD-A090644] N81-12146
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537
Description and utilization of a computation program of the optical radiation transmitted, emitted or diffused by the atmosphere for satellite observation --- spectral domain .3 to 25 microns
[ONERA-NT-1980-3] N81-12878

SATELLITE ORBITS
Station control and the orbit of Skylab during the period April 1978 to July 1979
[VTH-LR-288] N81-12131
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537

SATELLITE ORIENTATION
Design of the Annular Suspension and Pointing System (ASPS) (including design addendum)
[NASA-CR-3343] N81-12158

SATELLITE PERTURBATION
BIRAMIS: Numerical evaluation of the overall system precision --- radiation balance measurements by satellite-borne microaccelerometer
[ONERA-RT-7/3373-SY] N81-12159

SATELLITE POWER TRANSMISSION (TO EARTH)
Satellite power system concept development and evaluation program. Volume 1: Technical assessment summary report
[NASA-TM-58232] N81-12543
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659

SATELLITE SOLAR ENERGY CONVERSION
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560
Laser satellite power systems
[ANL/ES-92] N81-12592
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659

SATELLITE SOLAR POWER STATIONS
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS
[NASA-CR-3347] N81-12560
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659

SATELLITE TRACKING
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143

Accuracy of the determination of mean anomalies and mean geoid undulations from a satellite gravity field mapping mission
[REPT-307] N81-12669
Feasibility study of an integrated optic switching center --- satellite tracking application
[NASA-CR-160042] N81-12863

SATELLITE TRANSMISSION
Next generation communications satellites: Multiple access and network studies
[NASA-CR-165145] N81-12139

SATELLITE-BORNE INSTRUMENTS
Spaceborne laser range and range rate finder
[ESA-CR(P)-1367] N81-12420

SATURN RINGS
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964

SAUDI ARABIA
Oversight of energy development in Africa and the MIddle East
[GPO-60-580] N81-12567

SCALE MODELS
Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877

SCATTERING CROSS SECTIONS
Improved numerical techniques for processing Monte Carlo thermal scattering data
[BNL-28048] N81-12798
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2 --- conference
[LBL-9501-VOL-2] N81-12835
Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12847
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853

SCENE ANALYSIS
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506

SCHROEDINGER EQUATION
Bag model, the hyperspherical formalism and the heavy baryons
[BNL-28198] N81-12836
Nonlinear magnetohydrodynamics
[ORO-5260-4] N81-12896

SCINTILLATION COUNTERS
Optical fibers and avalanche photodiodes for scintillator counters
[BNL-28195] N81-12876

SEA ICE
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687

SEALS (STOPPERS)
Advanced transmission components investigation program: Bearing and seal development
[AD-A090675] N81-12075

SEAMS (JOINTS)
Ultrasonic seam welding
[BDX-613-2444] N81-12431

SECONDARY FLOW
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083

SECURITY
DOD-DOE Workshop on Joint Energy Activities
[CONF-800383] N81-12590

SEDIMENT TRANSPORT
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494

SEISMIC WAVES
Seismic response analysis for structures with non-orthogonal modes
[DP-MS/79-78] N81-12290
The 1976 earthquake sequence in Uzbekistan: Focal mechanisms determined using the relative amplitude method
[AWRE-O-27/80] N81-12692

SELENOGRAPHY
Selenocentric control system (1979)
[AD-A090543] N81-12969

SELF EXCITATION
Millimeter-wave self mixing oscillators
[AD-A090384] N81-12337

SELF ORGANIZING SYSTEMS
Automatic construction of semantic networks
[BMFT-FB-ID-79-05] N81-12781

SEMANTICS
Automatic construction of semantic networks
[BMFT-FB-ID-79-05] N81-12781
A natural data type with a finite equational final semantics specification but no effective equational initial semantics specification
[MC-IW-133/80] N81-12799

SEMICONDUCTOR DEVICES
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
Interdigitated back contact solar cells
[SAND-80-7104] N81-12607

SEMICONDUCTOR JUNCTIONS
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597

SEMICONDUCTOR LASERS
Room temperature, CW, single mode laser
[AD-A090326] N81-12410

SEMICONDUCTORS (MATERIALS)
Epitaxial growth of CdSnP2 on InP for microwave FETs
[AD-A090285] N81-12913
Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914

SEMISPAN MODELS
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448

SEPARATED FLOW
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
Compact numerical method for the simulation of separated viscous flow, stationary or not. Application
[AAAF-NT-80-04] N81-12374

SEPARATORS
Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953

SEQUENTIAL ANALYSIS
On limiting distributions of intermediate order statistics from stationary sequences
[AD-A090617] N81-12809

SERVICE LIFE
The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568
Research, development and demonstration of lead-acid batteries for electric vehicle propulsion
[ANL/OEPM-79-7] N81-12954

SET THEORY
Applications of efficient subset selection to digital filtering and to signal resolution
[AD-A090128] N81-12813

SHALE OIL
The Western Hemisphere energy system
[GPO-51-683] N81-12557
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649

SHEAR FLOW
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026
Sheared three dimensional flow around surface vehicles
[AAAF-NT-80-23] N81-12032
Sheared zone considerations in incompressible turbulent boundary layer calculations
[AAAF-NT-80-03] N81-12355
Method for calculating two dimensional sheared flow at high Reynolds numbers --- for viscous fluids
[AAAF-NT-80-01] N81-12372

SHEAR LAYERS
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825

SHEAR PROPERTIES
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257

SHEAR STRESS
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425

SHEARING
Calculations for nonstationary laminar flow subject to an average deceleration with shearing
[AAAF-NT-80-02] N81-12373

SHELTERS
Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287

SHOCK ABSORBERS
Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468

SHOCK FRONTS
Thickening of a shock front by the grain structure of a solid
[LA-8410-MS] N81-12369

SHOCK LOADS
Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263

SHOCK RESISTANCE
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698

SHOCK SPECTRA
Improved recursive formula for calculating shock response spectra
[SAND-80-1315C] N81-12367

SHOCK TUBES
Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188

SHOCK WAVES
A reaction mechanism in the shock initiation of detonation: A theoretical study
[AD-A090357] N81-12264

SHORELINES
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486

SHORT HAUL AIRCRAFT
Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) --- Lewis 9 by 15 foot low speed wind tunnel tests
[NASA-TP-1178] N81-12084

SHORT TAKEOFF AIRCRAFT
A computer program to calculate the longitudinal aerodynamic characteristics of upper-surface-blown wing-flap configurations
[NASA-CR-3005] N81-12014
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068

SHORT WAVE RADIATION
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688

SIDELOBE REDUCTION
Antenna sidelobe and interference reduction. Citations from the NTIS data base
[PB80-815186] N81-12322
SIGNAL DISTORTION
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
SIGNAL MEASUREMENT
A check panel for the MSE analytical ultracentrifuge N81-12404
SIGNAL PROCESSING
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143
Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection --- detecting aircraft from satellites
[AD-A090644] N81-12146
A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314
Light communications Systems. Citations from the NTIS data base
[PB80-815301] N81-12321
Antenna sidelobe and interference reduction. Citations from the NTIS data base
[PB80-815186] N81-12322
SWIFT
[AD-A090647] N81-12343
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386
Convergence of iterative nonexpansive signal reconstruction algorithms
[NASA-CR-163799] N81-12790
Applications of efficient subset selection to digital filtering and to signal resolution
[AD-A090128] N81-12813
SIGNATURE ANALYSIS
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509
Detection of signal signatures of cartographic features
[AD-A090375] N81-12531
SILICA GEL
Measurement of the solar radiative properties of silica gel
[VKI-TM-29] N81-12635
SILICON
The MSFC silicon gate silicon-on-sapphire standard cell library
[NASA-TM-78194] N81-12324
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163806] N81-12549
Solar silicon via the Dow Corning process
[NASA-CR-163798] N81-12551
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
Development of high efficiency (14 percent) solar cell array module
[NASA-CR-163808] N81-12553
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells
[DOE/ET-23108/4] N81-12601
Sequential purification and crystal growth for the production of low cost silicon substrates
[DOE/SERI/8229-3/2-T6] N81-12602
SILICON DIOXIDE
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154
SILICON FILMS
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389
SILICON JUNCTIONS
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925
SILICONES
Bonding silicons with epoxies
[BDX-613-2432] N81-12240
SILVER
Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873
SINE WAVES
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885
SINGLE CRYSTALS
Large high quality single crystal aluminum phosphate for acoustic wave devices
[AD-A090359] N81-12905
Czochralski growth of single-crystal gehlenite Ca2Al2SiO7
[CONF-800908-2] N81-12921
SIRIO SATELLITE
Study of the operational deployment of SIRIO-2 ground stations. Volume 1 --- meteorological data traffic
[ESA-CR(P)-1369-VOL-1] N81-12711
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
Study of the operational deployment of SIRIO-2 ground stations, volume 3 --- meteorological data distribution
[ESA-CR(P)-1369-VOL-3] N81-12713
SITE SELECTION
Air quality monitoring. Citations from the NTIS data base
[PB80-813470] N81-12666
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
SIZE DETERMINATION
Droplet size measurements in combustion by the visibility method N81-13014
SKIN (STRUCTURAL MEMBER)
Application of fracture mechanics to built-up structures --- aircraft handbooks
[NLR-MP-79044-U] N81-12475
SKIN FRICTION
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12327-1] N81-12390
SKY BRIGHTNESS
Some results of preliminary tests on values of sky-sea contrast (visible horizon) as a function of environmental parameters
[ESA-TT-623] N81-12691
SKYLAB 1
Station control and the orbit of Skylab during the period April 1978 to July 1979
[VTH-LR-288] N81-12131
SLAGS
MHD heat and seed recovery technology project
[ANL/MHD-80-1] N81-12898
SLIDING FRICTION
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226
Non-contacting power transfer device
[NASA-CASE-GSC-12595-1] N81-12331
SMOKE
Technical suppositions developed for smoke measurements during high pressure full annular combustor tests and engine trials N81-12995
SODIUM CHLORIDES
Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188
SODIUM SULFUR BATTERIES
Production technology of beta-alumina ceramics for Na/S batteries
[BMFT-FB-T-79-57] N81-12629
Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950
SOFTENING
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212
SOIL EROSION
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
SOIL MOISTURE
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
SOILS
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
SOLAR ARRAYS
Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
Development of high efficiency (14 percent) solar cell array module
[NASA-CR-163808] N81-12553
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
SOLAR CELLS
Solar cell system having alternating current output
[NASA-CASE-LEW-12806-2] N81-12542
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163806] N81-12549
Solar silicon via the Dow Corning process
[NASA-CR-163798] N81-12551
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
Development of high efficiency (14 percent) solar cell array module
[NASA-CR-163808] N81-12553
Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564
Solar cell utilizing photochemical generation of electricity
[DOE/R5-10114/1] N81-12581
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells
[DOE/ET-23108/4] N81-12601
Low cost thin film polycrystalline silicon solar cells
[DOE/ET-23048/T1] N81-12603
Interdigitated back contact solar cells
[SAND-80-7104] N81-12607
Automated linear concentrator cell module assembly
[SAND-80-7103] N81-12610
Indium phosphide/cadmium sulfide thin-film solar cells
[SERI/PR-8170-1-T1] N81-12616
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
High efficiency GaAs-GaAlAs solar cells for very high concentration systems
[CISE-1517] N81-12630
SOLAR COLLECTORS
Study of aluminum corrosion in aluminum solar heat collectors using aqueous glycol solution for heat transfer
[DOE/CS-3107/T2] N81-12215
Point Focusing Thermal and Electric Applications Project. Volume 2: Workshop proceedings
[NASA-CR-163804] N81-12548

US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572
Development of a low-cost solar panel using laminated polymer films
[ALO-4121-2] N81-12577
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596
Low cost, bare plate solar air collector
[DOE/R5-10143/1] N81-12605
Heliostat mirror survey and analysis
[PNL-3194] N81-12609
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
Flat plate solar collector design and performance. Citations from the Engineering Index data base
[PB80-814122] N81-12638
Flat plate solar collector design and performance. Citations from the NTIS data base
[PB80-814130] N81-12639
Solar energy concentrator design and operation. Citations from the Engineering Index data base
[PB80-813934] N81-12642
Fundamentals and techniques of nonimaging optics for solar energy concentration
[DOE/ER-10575/1] N81-12874
The DOE photovoltaics program N81-12989

SOLAR COOLING

Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings
[GPO-57-523] N81-12563
Solar atrium: A hybrid solar heating and cooling system
[DOE/EG-34135/10] N81-12585
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625

SOLAR ELECTRIC PROPULSION

Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547
Point Focusing Thermal and Electric Applications Project. Volume 2: Workshop proceedings
[NASA-CR-163804] N81-12548

SOLAR ENERGY

Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575
Solar energy in Australia: A profile of renewable energy activity in its national context
[SERI/SP-763] N81-12578
Preliminary designs: Passive solar manufactured housing
[DOE/CS-30377/1] N81-12583
Solar hot water space heating system
[DOE/CS-34412/18] N81-12584
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
Argonne solar energy program. Summary of solar program activities
[ANL-80-80] N81-12622
Solar-augmented applications in industry
[PB80-205313] N81-12643

SOLAR ENERGY CONVERSION

Solar energy in Australia: A profile of renewable energy activity in its national context
[SERI/SP-763] N81-12578
Fundamentals and techniques of nonimaging optics for solar energy concentration
[DOE/ER-10575/1] N81-12874
Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952
Solar photovoltaics: Stand alone applications --- NASA Lewis Research Center research and development N81-12990

SOLAR FLARES

On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973

SOLAR GENERATORS

Development of a fold-out rigid solar array for three axis-stabilized geosynchronous satellites
[SNIAS-801-440-101] N81-12150
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600
Contribution to the study of the internal mechanics of a space photovoltaic generator
[ESA-STR-205] N81-12631

SOLAR HEATING

Study of aluminum corrosion in aluminum solar heat collectors using aqueous glycol solution for heat transfer
[DOE/CS-3107/T2] N81-12215
Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
Review of title 5 of the National Energy Conservation Policy Act --- solar heating and cooling of federal buildings
[GPO-57-523] N81-12563
Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
Solar atrium: A hybrid solar heating and cooling system
[DOE/EG-34135/10] N81-12585
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses
[ERG-031] N81-12632

SOLAR HOUSES

Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses
[ERG-031] N81-12632

SOLAR PONDS (HEAT STORAGE)

Experimental and theoretical study of thermal performance of a hybrid solar system at Living History Farms
[DOE/CS-34136/1] N81-12606

SOLAR POWER SATELLITES

Solar power satellites. A review of the space transportation options
[RAE-TR-80034] N81-12153
Satellite power system concept development and evaluation program. Volume 1: Technical assessment summary report
[NASA-TM-58232] N81-12543

SOLAR RADIATION

Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574
High efficiency GaAs-GaAlAs solar cells for very high concentration systems
[CISE-1517] N81-12630
Measurement of the solar radiative properties of silica gel
[VKI-TM-29] N81-12635

SOLAR REFLECTORS

Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
Open-loop heliostat reflector
[UCID-18764] N81-12587
Heliostat mirror survey and analysis
[PNL-3194] N81-12609

SOLAR SPECTRA

Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401

SOLAR TERRESTRIAL INTERACTIONS

Impulsive penetration of solar wind plasma and its effects on the upper atmosphere
[AERONOMICA-ACTA-A-207-1979] N81-12971

SOLAR TOTAL ENERGY SYSTEMS

Solar total energy modularity study
[SAND-80-7060] N81-12608

SOLAR WIND

Spacecraft charging on ATS-5
[AD-A090508] N81-12147
A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
Impulsive penetration of solar wind plasma and its effects on the upper atmosphere
[AERONOMICA-ACTA-A-207-1979] N81-12971

SOLAR WIND VELOCITY

Reduction and analysis of ATS-6 data
[NASA-CR-160052] N81-12683

SOLAR X-RAYS

On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973

SOLENOIDS

Strongly-localized ballooning modes in a tandem mirror
[SAI-254-80-493-LJ] N81-12890

SOLID CRYOGEN COOLING

Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157

SOLID LUBRICANTS

Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226
Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233

SOLID PROPELLANT IGNITION

The use of an arc image furnance for solid propellant ignition studies. An undergraduate student report
[PERME-MEMO-111] N81-12282

SOLID PROPELLANTS

Effects of advances in propulsion technology on missile effectiveness --- solid fuel ramjets
[AD-A090645] N81-12106
Three dimensional finite element combustion instability analysis
[AD-A090396] N81-12194
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262

SOLID ROCKET PROPELLANTS

IRIS derived rocket (IDR) to be used as Ariane 4th stage
[ESA-CR(P)-1370] N81-12166

The use of an arc image furnance for solid propellant ignition studies. An undergraduate student report
[PERME-MEMO-111] N81-12282

SOLID STATE
Photoemission from solids: The transition from solid-state to atomic physics
[LBL-11276] N81-12871

SOLID SUSPENSIONS
Measurement of suspended solids in lakes and oceans using satellite remote sensing data
N81-12510

SOLID WASTES
Energy from municipal solid wastes
[GPO-61-252] N81-12566
State-of-the-art report on low-level radioactive waste treatment
[ORNL/TM-7427] N81-12858

SOLIDIFIED GASES
Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157

SOLIDS
Investigation of noise in solids at low temperatures
[AD-A090805] N81-12907

SOLITARY WAVES
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885

SORBENTS
Regenerative process for desulfurization of high temperature combustion and fuel gases
[BNL-51223] N81-12203

SORGHUM
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480

SOS (SEMICONDUCTORS)
High speed CMOS/SOS standard cell notebook
[NASA-CR-150783] N81-12323
The MSFC silicon gate silicon-on-sapphire standard cell library
[NASA-TM-78194] N81-12324
Trends and techniques for space base electronics --- mathematical models, ion implantation, and semiconductors
[NASA-CR-150825] N81-12329

SOUND PRESSURE
A comparison of the three methods used to obtain acoustic measurements for the NASA Flight Effects Program
[NASA-TM-81906] N81-12622

SOUND RANGING
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536

SOUND TRANSMISSION
Acoustic transmission matrix of a variable area duct or nozzle carrying a compressible subsonic flow
[NASA-TM-81614] N81-12621

SOUND WAVES
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12316
Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471
Atmospheric echo sounding. Citations from the NTIS data base
[PB80-815004] N81-12694

SOUNDING
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687
Atmospheric echo sounding. Citations from the NTIS data base
[PB80-815004] N81-12694

SOUTH AFRICA
Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567

SOUTH DAKOTA
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514

SOUTHERN HEMISPHERE
Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685

SOYBEANS
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans — U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10026] N81-12505
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509

SPACE CHARGE
Analysis of spacecraft charging and geophysical data bases
[AD-A090020] N81-12141
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236

SPACE COMMUNICATION
Correlation and prediction of propagation time-delays along earth-space links
[AD-A090441] N81-12313

SPACE COOLING (BUILDINGS)
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604

SPACE ERECTABLE STRUCTURES
Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445

SPACE HEATING (BUILDINGS)
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings --- bibliographies
[DOE/IR-06065/1-PT-1] N81-12582
Solar hot water space heating system
[DOE/CS-34412/18] N81-12584
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
Energy use in office buildings. Volume 1: Analysis of 1977 office building energy use as reported in the Building Owners and Managers Association Data Base
[DOE/CS-20189/1] N81-12593
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
Low cost, bare plate solar air collector
[DOE/R5-10143/1] N81-12605
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655

SPACE LABORATORIES
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883

SPACE LAW
The Moon treaty
[GPO-66-705] N81-12937
Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-66-836] N81-12939

SPACE PLATFORMS
Geostationary platform systems concepts definition follow-on study. Volume 2A: Technical Task 2 LSST special emphasis
[NASA-CR-161597] N81-12133
Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445

SPACE PROCESSING
Materials processing in space: Future technology trends N81-12991

SPACE PROGRAMS
United States civilian space policy
[GPO-66-883] N81-12941
Aeronautics and Space Report of the President, 1979 activities N81-12956

SPACE SHUTTLE ORBITERS
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154

SPACE SHUTTLE PAYLOADS
NOSS flight segment concept study
[NASA-TM-82307] N81-12124
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380
Materials processing in space: Future technology trends N81-12991

SPACE SHUTTLES
Space shuttle and Galileo mission
[GPO-53-938] N81-12940

SPACE SURVEILLANCE (SPACEBORNE)
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143

SPACE TRANSPORTATION
Solar power satellites. A review of the space transportation options
[RAE-TR-80034] N81-12153

SPACE TRANSPORTATION SYSTEM
An assessment of the atmospheric effects of a satellite power system
[CONF-791204-39] N81-12705
Space shuttle and Galileo mission
[GPO-53-938] N81-12940

SPACEBORNE EXPERIMENTS
Materials processing in space: Future technology trends N81-12991

SPACEBORNE PHOTOGRAPHY
Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508

SPACEBORNE TELESCOPES
Composite materials applied to aerospace structures
[AAAF-NT-79-45] N81-12184

SPACECRAFT CHARGING
Groundbased predictors of spacecraft charging during eclipse passage
[AD-A090338] N81-12148
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide --- aerospace materials
[ESA-STM-213] N81-12251

SPACECRAFT COMMUNICATION
Development of a fold-out rigid solar array for three axis-stabilized geosynchronous satellites
[SNIAS-801-440-101] N81-12150

SPACECRAFT CONTROL
Closed loop control systems: Miscellaneous applications. Citations from the NTIS data base
[PB80-813702] N81-12783

SPACECRAFT DESIGN
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
AVHRR/1-FM Advanced Very High Resolution Radiometer
[NASA-CR-160059] N81-12392

SPACECRAFT INSTRUMENTS
Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157

SPACECRAFT POWER SUPPLIES
Rationalization of power subsystem design specifications for ESA spacecraft
[ESA-CR(P)-1348] N81-12163

SPACECRAFT RADIATORS
Study of heat rejection systems --- in Spacelab
[TC-80-TR-0050] N81-12379
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380

SPACECRAFT STABILITY
Method of and apparatus for damping nutation motion with minimum spin axis attitude disturbance
[NASA-CASE-GSC-12551-1] N81-12156
SPACELAB
Study of heat rejection systems --- in Spacelab
[TC-80-TR-0050] N81-12379
SPACELAB PAYLOADS
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
[DS-ERT-14/80] N81-12381
Materials processing in space: Future technology trends N81-12991
SPARE PARTS
Naval aircraft operating and support cost-estimating model: FY78 revision
[AD-A090044] N81-12013
SPARK GAPS
Pulse power switch development
[AD-A090511] N81-12339
SPATIAL DISTRIBUTION
Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696
SPECIFICATIONS
Flammability testing --- aerospace materials
[ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
A natural data type with a finite equational final semantics specification but no effective equational initial semantics specification
[MC-IW-133/80] N81-12799
SPECTRA
Electronic band structure and optical properties of the cubic, Sc, Y and La hydride systems
[IS-T-899] N81-12918
SPECTRAL REFLECTANCE
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
SPECTRAL SIGNATURES
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
SPECTROMETERS
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958
SPECTROPHOTOMETRY
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
SPECTROSCOPIC ANALYSIS
Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904
SPECTRUM ANALYSIS
Spectral analysis of nonstationary random processes. Application to noise of flyover type
[ESA-TT-639] N81-12826
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
SPECULAR REFLECTION
Development of a second generation portable specular reflectometer
[SAND-80-1509C] N81-12402
Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces
[COO-4381-10] N81-12873
SPEECH RECOGNITION
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet --- earphones
[RAE-TM-FS-313] N81-12320
Experiments on speech recognition by linear prediction
[ENST-C-79020] N81-12782
SPENT FUELS
Spent fuel handling and packaging program
[DOE/NV-10061/3] N81-12851
Proposed rulemaking on the storage and disposal of nuclear waste. Cross statement of the United States Department of Energy
[DOE/NE-0007-SUPPL-1] N81-12855
A laser surveillance system for spent fuel
[BNL-28054] N81-12860
The APEX accelerator cycle for transmutation of long-lived fission wastes
[BNL-28282] N81-12861
SPHERICAL SHELLS
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123
SPIN
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142
SPIN EXCHANGE
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912
SPIN-SPIN COUPLING
Rigid muffin-tin approximation for the electron-phonon interaction in transition metals
[CONF-800864-1] N81-12839
SPIRAL GALAXIES
Search for faint galactic features --- digital image processing
[LA-UR-80-2357] N81-12960
SPIRAL WRAPPING
Modified spiral wound retaining ring
[NASA-CASE-LAR-12361-1] N81-12422
SPOT WELDS
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432
SPRAYED COATINGS
Aircraft surface coatings study: Energy efficient transport program --- sprayed and adhesive bonded coatings for drag reduction
[NASA-CR-158954] N81-12225
SPRAYING
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004
SPREAD SPECTRUM TRANSMISSION
The multiple stack algorithm implemented on a Zilog Z-80 microcomputer
[AD-A090606] N81-12791
SPUTTERING
Thin-film coatings N81-12983
STABILITY
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
Laser like approach to the dynamics of convective instabilities
[CISE-1533] N81-12371
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12697
STABILITY TESTS
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
STACKS
Tracking of smokestack and cooling tower plumes using wind measurements at different levels
[ORNL/TM-7417] N81-12654
STANDARDIZATION
Rationalization of power subsystem design specifications for ESA spacecraft
[ESA-CR(P)-1348] N81-12163
STANDARDS
Software standards in chemistry
[LBL-9881] N81-12169
Developments in United Kingdom waveguide power standards
[RSRE-80006] N81-12319
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596
Reliable software: Standards for the production of high quality systems --- esa satellites
[ESA-CR(P)-1358] N81-12770
STANTON NUMBER
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
STAR TRACKERS
Astroinertial navigation for cruise applications
[AD-A090649] N81-12059
STATIC PRESSURE
In-flight boundary-layer measurements on a hollow cylinder at a Mach number of 3.0
[NASA-TP-1764] N81-12361
STATIC STABILITY
Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields
[AD-A090361] N81-12332
STATIC TESTS
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
STATISTICAL ANALYSIS
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449
Two experiments on statistical image segmentation
[AD-A089484] N81-12764
In search of correlation in multiplicative congruential generators with modulus (2 to the 31st power) minus 1
[AD-A090636] N81-12808
Nonlinear magnetohydrodynamics
[ORO-5260-4] N81-12896
STATISTICAL DISTRIBUTIONS
On limiting distributions of intermediate order statistics from stationary sequences
[AD-A090617] N81-12809
STATORS
The effects of solidity, interblade phase angle and reduced frequency on the time-variant aerodynamic response of a compressor stator
[AD-A090546] N81-12108
STEELS
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223
Inert gas welding. Citations from the Engineering Index data base
[PB80-815228] N81-12436
Inert gas welding. Citations from the NTIS data base
[PB80-815210] N81-12437
Fatigue crack propagation and corrosion fatigue of AF 1410 steel
[AD-A090497] N81-12453

Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456

STEERING
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424

STELLAR ATMOSPHERES
Scientific management and implementation of the geophysical fluid flow cell for Spacelab missions
[NASA-CR-161612] N81-12123

STELLAR LUMINOSITY
An X-ray survey of nine historical novae --- HEAO 2 observations
[NASA-TM-82014] N81-12961

STELLAR MAGNETIC FIELDS
Toroidal plasma equilibrium with gravity --- stellar magnetic fields
[PPPL-1704] N81-12895

STELLAR MASS ACCRETION
White dwarf models for type 1 supernovae and quiet supernovae, and presupernova evolution
[NASA-TM-82030] N81-12957

STELLAR SPECTRA
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974

STOCHASTIC PROCESSES
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778

Stochastic approximation with discontinuous dynamics and state dependent noise w.p.1 convergence
[AD-A089777] N81-12805

Optimal regulation in systems with stochastic time sampling
[NASA-TP-1743] N81-12812

STOICHIOMETRY
Czochralski growth of single-crystal gehlenite Ca2Al2SiO7
[CONF-800908-2] N81-12921

STORAGE BATTERIES
The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568

Storage batteries for electric vehicle applications
[GPO-57-671] N81-12945

STRAIN ENERGY METHODS
Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801

Finite element analysis of crack growth
[NLR-MP-78017-U] N81-12802

STRAIN GAGE BALANCES
A comparison of methods for calibration and use of multi-component strain gauge wind tunnel balances
[AD-A090484] N81-12394

STRAIN GAGES
A modified T-value method for selection of strain gages for measuring loads on a low aspect ratio wing
[NASA-TP-1748] N81-12066

STRAIN RATE
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994

STRATOSPHERE
Stratospheric layering photographed --- from a balloon gondola
[AERONOMICA-ACTA-C-54-1979] N81-12674

The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675

The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679

STREAMS
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511

STRESS (PHYSIOLOGY)
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727

STRESS (PSYCHOLOGY)
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech
[RAE-TM-FS-334] N81-12737

STRESS ANALYSIS
A statistical consideration of Miner's rule
[NAL-TR-611T] N81-12449

Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454

Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455

Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465

Green's function in fracture mechanics
[RAE-TR-80035] N81-12469

Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627

STRESS CONCENTRATION
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403

Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467

Green's function in fracture mechanics
[RAE-TR-80035] N81-12469

STRESS CORROSION
Effect of various surface protections on the stress corrosion behavior of light alloys --- aluminum alloys
[SNIAS-801-551-102] N81-12220

STRESS CORROSION CRACKING
Micromechanisms of crack growth in ceramics and glasses in corrosive environments
[AD-A090735] N81-12232

Evaluation of improved polyamides
[BDX-613-2354] N81-12241

STRESS MEASUREMENT
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082

Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471

STRESS-STRAIN DIAGRAMS
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229

OPTIM III: A NASTRAN compatible large scale automated minimum weight design problem. Users and programmers manual
[AD-A090334] N81-12458

STRESSES
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226

STRINGERS
Application of fracture mechanics to built-up structures --- aircraft handbooks
[NLR-MP-79044-U] N81-12475

STRUCTURAL ANALYSIS
The effect of thermal stresses on the integrity of three built-up aircraft structures
[NASA-TM-81352] N81-12064

Geostationary platform systems concepts definition follow-on study. Volume 2A: Technical Task 2 LSST special emphasis
[NASA-CR-161597] N81-12133

Aeroelastic optimization with multiple constraints
[AD-A090775] N81-12451

GRID and CQUAD: Two preprocessing codes for NASTRAN
[AD-A090664] N81-12460

Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467

Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468

The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470

Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801

Brillouin scattering studies of the effect of orientation on the mechanically deformed poly-(ethylene terepthalate)
[AD-A090589] N81-12866

STRUCTURAL DESIGN
Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287

Preliminary study on the potential usefulness of array processor techniques for structural synthesis
[NASA-CR-163801] N81-12447

Lagrangian three-dimensional finite-element formulation for the nonlinear fluid-structural response of reactor components
[ANL-80-26] N81-12461

Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624

Application of a method for aerodynamic analysis and design of horizontal axis wind turbines, part 1
[FFA-TN-AU-1499-PT-1] N81-12633

STRUCTURAL DESIGN CRITERIA
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077

Deployable and erectable concepts for large spacecraft --- determining structural proportions of space platforms for STS delivery
[NASA-TM-81904] N81-12445

Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464

Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627

STRUCTURAL ENGINEERING
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283

Proceedings of the Army symposium on solid mechanics. Designing for extremes: Environment, Loading, and Structural Behavior
[AD-A090684] N81-12285

Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286

Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287

STRUCTURAL PROPERTIES (GEOLOGY)
Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500

Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508

STRUCTURAL STABILITY
Laser interaction with TBR materials
[AD-A090429] N81-12177

STRUCTURAL STRAIN
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403

STRUCTURAL VIBRATION
Spacecraft structural acoustic studies. Investigation, interpretation, and simulation of the effects of configuration features on noise. Induced structural vibration and sound transmission characteristics
[BAE-ESA/B44/40013] N81-12472

OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556

STRUTS
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283

SUBROUTINES
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
CDC 6600/7600 subroutine for bessel functions Y/sub nx x 0, nu or = 0
[SAND-80-1498] N81-12796
SUBSONIC FLOW
Transonic flow computations with separate treatment of the subsonic and supersonic regions
[AD-A090327] N81-12025
SUBSONIC FLUTTER
System to measure the pressure distribution on fan aerofoil surfaces during flutter conditions
[PNR-90013] N81-12029
SUBSTRATES
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389
Sequential purification and crystal growth for the production of low cost silicon substrates
[DOE/SERI/8229-3/2-T6] N81-12602
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
SULFATION
Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216
SULFIDES
Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615
SULFONES
Polyketones and polysulfones for conservation in the ethylene polymer
[BNL-51155] N81-12237
SUMMER
The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A --- monsoon experiment N81-12710
SUNFLOWERS
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
SUPERCONDUCTING MAGNETS
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618
SUPERCONDUCTIVITY
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924
SUPERCONDUCTORS
A15 multifilamentary superconductors by the infiltration process
[LBL-10761] N81-12342
SUPERCRITICAL WINGS
Boundary layer measurements on a two dimensional wing with flap and a comparison with calculations
[NLR-MP-79034-U] N81-12036
SUPERNOVAE
White dwarf models for type 1 supernovae and quiet supernovae, and presupernova evolution
[NASA-TM-82030] N81-12957
SUPERPLASTICITY
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221
SUPERSONIC AIRCRAFT
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043
SUPERSONIC AIRFOILS
Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2
[NASA-CR-159879] N81-12087
SUPERSONIC COMBUSTION
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
SUPERSONIC COMMERCIAL AIR TRANSPORT
Design of a multivariable integrated control for a supersonic propulsion system --- variable stream control engine N81-12094
SUPERSONIC DRAG
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
SUPERSONIC FLOW
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023
Transonic flow computations with separate treatment of the subsonic and supersonic regions
[AD-A090327] N81-12025
SUPERSONIC SPEEDS
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds
[AD-A090443] N81-12027
SUPPORTS
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
SURFACE CRACKS
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452
SURFACE FINISHING
Effect of various surface protections on the stress corrosion behavior of light alloys --- aluminum alloys
[SNIAS-801-551-102] N81-12220
Aircraft surface coatings study: Energy efficient transport program --- sprayed and adhesive bonded coatings for drag reduction
[NASA-CR-158954] N81-12225
Deburring: Technical capabilities and cost-effective approaches, lessons 5 and 6
[BDX-613-2382] N81-12288
The development of a method of producing etch resistant wax patterns on solar cells
[NASA-CR-163606] N81-12549
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
SURFACE LAYERS
Surface and catalysis science in the Materials and Molecular Research Division
[DOE/TIC-11225] N81-12202
Coal thickness guage using RRAS techniques, parts 2 and 3
[NASA-CR-161607] N81-12524
SURFACE PROPERTIES
Method for producing thin sheets of proton-sensitive CR-39 plastic track detectors
[NASA-CR-160037] N81-12175
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
SURFACE REACTIONS
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
Surface and catalysis science in the Materials and Molecular Research Division
[DOE/TIC-11225] N81-12202
Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904
SURFACE ROUGHNESS
Overlapped subarraying techniques
[AD-A089693] N81-12304
SURFACE TEMPERATURE
The decomposition of N2O on Ni (110)
[AD-A090552] N81-12193
Curved film cooling admission tube
[NASA-CASE-LEW-13174-1] N81-12363
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Veves, France
[E81-10040] N81-12522
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703
SURFACE VEHICLES
Sheared three dimensional flow around surface vehicles
[AAAF-NT-80-23] N81-12032
Test track facilities --- military vehicles
[MVEE-MEMO-79021] N81-12122
SURFACE WAVES
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
SURVEILLANCE RADAR
A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314
SWEPT FORWARD WINGS
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.9 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448
SWITCHES
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
Feasibility study of an integrated optic switching center --- satellite tracking application
[NASA-CR-160042] N81-12863
SWITCHING
Feasibility study of an integrated optic switching center --- satellite tracking application
[NASA-CR-160042] N81-12863
SWITCHING CIRCUITS
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
SWITCHING THEORY
Next generation communications satellites: Multiple access and network studies
[NASA-CR-165145] N81-12139
A uniform representation of single and multi-stage interconnection networks used in SIMD machines
[AD-A089688] N81-12300
SWITZERLAND
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
SYNCHRONOUS SATELLITES
Spacecraft charging on ATS-5
[AD-A090508] N81-12147
Groundbased predictors of spacecraft charging during eclipse passage
[AD-A090338] N81-12148
Reduction and analysis of ATS-6 data
[NASA-CR-160052] N81-12683
SYNCHROTRON RADIATION
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722
SYNTHESIS (CHEMISTRY)
Heat resistant plastics: Silicone, carborane, halocarbon, and other polymers. Citations from the NTIS data base
[PB80-814734] N81-12253

Heat resistant plastics: Nitrogen containing polymers. Citations from the NTIS data base
[PB80-814742] N81-12254

SYNTHETIC APERTURE RADAR

Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537

SYNTHETIC FUELS

Development of alcohol-based synthetic transportation fuels from coal-derived synthesis gases
[DOE/ET-14858/2] N81-12266

The flash hydrogenation of biomass
[BNL-28297] N81-12277

Priority energy project act of 1979
[GPO-58-154] N81-12555

Oversight of energy development in Africa and the Middle East
[GPO-60-580] N81-12567

Wastes and biomass as energy resources
[CONF-790512-1] N81-12570

The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649

SYNTHETIC RESINS

Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243

SYSTEM EFFECTIVENESS

Effects of advances in propulsion technology on missile effectiveness --- solid fuel ramjets
[AD-A090645] N81-12106

SYSTEM FAILURES

Aircraft accident reports. Brief format, US civil aviation: Issue no. 11, 1979 accidents
[NTSB-BA-80-8] N81-12053

SYSTEMS ANALYSIS

YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067

Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575

Wind energy systems: Program summary
[DOE/CS-20097/01] N81-12580

Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600

An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618

SYSTEMS ENGINEERING

NOSS flight segment concept study
[NASA-TM-82307] N81-12124

BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128

Design of the Annular Suspension and Pointing System (ASPS) (including design addendum)
[NASA-CR-3343] N81-12158

System design of advanced carbide fuel
[COO-2426-205] N81-12265

Study of heat rejection systems --- in Spacelab
[TC-80-TR-0050] N81-12379

Design studies for a far infrared absolute spectrometer for the cosmic background explorer
[NASA-CR-160051] N81-12385

DYMAC digital electronic balance
[LA-8313-M] N81-12398

A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462

Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574

Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576

Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725

Fundamentals and techniques of nonimaging optics for solar energy concentration
[DOE/ER-10575/1] N81-12874

Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943

Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950

Research, development and demonstration of nickel-zinc batteries for electric vehicle propulsion
[ANL/OEPM-79-10] N81-12953

Progress in materials and structures at Lewis Research Center N81-12982

The DOE photovoltaics program N81-12989

T

TABLES (DATA)

A modified T-value method for selection of strain gages for measuring loads on a low aspect ratio wing
[NASA-TP-1748] N81-12066

Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252

TAIL ASSEMBLIES

Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mohawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044

TAKEOFF

Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089264] N81-12068

TAKEOFF RUNS

A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043

TANKS (COMBAT VEHICLES)

A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424

TANKS (CONTAINERS)

Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221

TAR SANDS

The Western Hemisphere energy system
[GPO-51-683] N81-12557

TARGET ACQUISITION

Frequency diverse tracking/guidance millimeter radar adapted to target acquisition
[AD-A090355] N81-12305

TARGET RECOGNITION

Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143

Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection --- detecting aircraft from satellites
[AD-A090644] N81-12146

A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314

Detection of signal signatures of cartographic features
[AD-A090375] N81-12531

TEA LASERS

Pulse code modulation of CO2 tea laser pulse
[AD-A090436] N81-12412

TEARING MODE (PLASMAS)

Trapped electron modifications to tearing modes in the low collision frequency limit
[SAI-245-80-348-LJ] N81-12846

TECHNOLOGICAL FORECASTING

Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039

Propulsion controls N81-12095

Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096

Alternative transportation fuels
[CONF-800419-5] N81-12267

Wind energy systems: Program summary
[DOE/CS-20097/01] N81-12580

Materials processing in space: Future technology trends N81-12991

TECHNOLOGY ASSESSMENT

Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078

A technology development program for large space antennas
[NASA-TM-81902] N81-12155

The development of the composite material engine nacelle
[AAAF-NT-79-38] N81-12180

Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216

Composition of liquids from coals of different rank
[DOE/BETC-RI-80/1] N81-12268

Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271

Nondestructive testing information analysis center, 1979
[AD-A090718] N81-12442

Remote Sensing For Water Resources And Hydrology. Recommended research emphasis for the 1980's
[NASA-CR-163791] N81-12529

US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572

Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574

Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579

Interdigitated back contact solar cells
[SAND-80-7104] N81-12607

Neutral beam development plan
[DOE/ER-0075] N81-12856

Energy overview N81-12979

NASA Research in aeropropulsion N81-12980

TECHNOLOGY TRANSFER

Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490

Remote sensing program activity report --- Vermont
[E81-10015] N81-12492

The foundations of United States information policy
[PB80-204019] N81-12933

Key issues in US-USSR scientific exchanges and technology transfer
[GPO-50-111] N81-12946

Technology transfer to China
[GPO-58-034] N81-12947

Technology transfer to China
[GPO-62-976] N81-12948

Solar photovoltaics: Stand alone applications --- NASA Lewis Research Center research and development N81-12990

TECHNOLOGY UTILIZATION

Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138

Advanced industrial gas turbine techology readiness demonstration
[DOE/OR-05035/T1] N81-12426

Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547

Energy research and extension
[GPO-61-544] N81-12562

Wind energy systems: Program summary
[DOE/CS-20097/01] N81-12580

Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600

Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952

TECTONICS

Structural mapping from MSS-LANDSAT imagery: A proposed methodology for international geological correlation studies
[E81-10023] N81-12500

TEETH

Acoustic tooth cleaner
[NASA-CASE-LAR-12471-1] N81-12724

TEFLON (TRADEMARK)
Mission integration study for solid Teflon pulsed plasma millipound propulsion system
[AD-A090514] N81-12162
TELECOMMUNICATION
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967 - 1980 reference book, volume 1
[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813793] N81-12636
Energy conservation: Policies, programs, and general studies. Citations from the NTIS data base
[PB80-813785] N81-12637
AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935
TELEMETRY
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
TELEVISION SYSTEMS
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942
TELEVISION TRANSMISSION
Wideband multiplex system
[AD-A090770] N81-12312
TEMPERATURE CONTROL
Investigation on adaptations to an existing heat pipe test platform for flight on the Spacelab/SPAS --- Spacelab Pallet Satellite
[ESA-CR(P)-1359] N81-12380
TEMPERATURE DISTRIBUTION
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
TEMPERATURE EFFECTS
Interlevel correlations of temperature and density, surface to 60 km
[AD-A090515] N81-12130
Study of space micropropulsion by hydrazine thermal decomposition. Laboratory tests
[AAAF-NT-80-28] N81-12281
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910
TEMPERATURE GRADIENTS
Heat pipe honeycomb panel
[NASA-CASE-LAR-12637-1] N81-12362
HCMM/soil moisture experiment --- relationship between surface minus air temperature differential and available water according to crop type in Canada
[E81-10022] N81-12499
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
TEMPERATURE MEASUREMENT
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994
Correlation measurement of velocity and temperature fluctuations in a free jet diffusion flame N81-13002
Velocity and temperature measurements in a premixed flame within an axisymmetric combustor N81-13006
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
Flame temperature profiles obtained by the two-line atomic fluorescence method N81-13012
Applications of optical diagnostic techniques in combustion research N81-13013
TENNESSEE
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
Applications of HCMM satellite data to the study of urban heating patterns
[E81-10025] N81-12502
TENNESSEE VALLEY (AL-KY-TN)
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
TENSORS
Quadric solids and computational geometry
[BDX-613-2484] N81-12794
TERMINAL GUIDANCE
A mathematical model of the CH-53 helicopter
[NASA-TM-81238] N81-12065
TERNARY ALLOYS
A15 multifilamentary superconductors by the infiltration process
[LBL-10761] N81-12342
TERNARY SYSTEMS
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924
TERRAIN ANALYSIS
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
Remote sensing and image interpretation
[E81-10036] N81-12518
Detection of signal signatures of cartographic features
[AD-A090375] N81-12531
TEST CHAMBERS
A comparison between electric field strengths similarly generated and measured in the open air, in a shielded enclosure and in a large aircraft hangar, over frequency range 10 to 110 MHz
[RSRE-MEMO-3248] N81-12353
TEST EQUIPMENT
A check panel for the MSE analytical ultracentrifuge N81-12404
TEST FACILITIES
Test track facilities --- military vehicles
[MVEE-MEMO-79021] N81-12122
Summary of pacific missile test center meteorological support Air Quality Assessment Model (AQAM) tests at the Naval Air Station, Mirimar, 1 to 8 August 1979
[AD-A090529] N81-12650
TEST FIRING
Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060
TEXAS
Houston area multicrop inspection trips --- Wharton County, Texas
[E81-10003] N81-12480
THEMATIC MAPPING
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519
THEOREM PROVING
Maximizing the intersection density of fiber processes
[CTH-MATH-1980-4] N81-12185
A characterization of Gorenstein orders in quaternion algebras
[CTH-MATH-1980-6] N81-12816
THERMAL BLOOMING
Atmospheric effects on laser beams. Citations from the NTIS data base
[PB80-814908] N81-12421
THERMAL CONDUCTIVITY
Phenolic resin syntactic foams
[BDX-613-2408] N81-12244
Heat pipe honeycomb panel
[NASA-CASE-LAR-12637-1] N81-12362
THERMAL CONTROL COATINGS
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide --- aerospace materials
[ESA-STM-213] N81-12251
THERMAL DIFFUSION
MHD heat and seed recovery technology project
[ANL/MHD-80-1] N81-12898
THERMAL EMISSION
Nitric oxide cooling in the terrestrial thermosphere
[AERONOMICA-ACTA-A-214-1980] N81-12673
THERMAL ENERGY
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547
Point Focusing Thermal and Electric Applications Project. Volume 2: Workshop proceedings
[NASA-CR-163804] N81-12548
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575
THERMAL ENVIRONMENTS
Laser interaction with TBR materials
[AD-A090429] N81-12177
THERMAL MAPPING
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
Remote sensing and image interpretation
[E81-10036] N81-12518
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site --- France
[E81-10039] N81-12521
A study of radiometric surface temperatures: Their fluctuations, distribution and meaning --- Voves, France
[E81-10040] N81-12522
A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
[NASA-TM-82019] N81-12526
THERMAL NOISE
Investigation of noise in solids at low temperatures
[AD-A090805] N81-12907
THERMAL REACTORS
Improved numerical techniques for processing Monte Carlo thermal scattering data
[BNL-28048] N81-12798
THERMAL RESISTANCE
Heat resistant plastics: Silicone, carborane, halocarbon, and other polymers. Citations from the NTIS data base
[PB80-814734] N81-12253

Heat resistant plastics: Nitrogen containing polymers. Citations from the NTIS data base
[PB80-814742] N81-12254

THERMAL STABILITY
Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260

THERMAL STRESSES
The effect of thermal stresses on the integrity of three built-up aircraft structures
[NASA-TM-81352] N81-12064
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454

THERMALIZATION (ENERGY ABSORPTION)
Absorption of magnetoacoustic waves in a high beta plasma
[IPF-79-3] N81-12900

THERMOCHEMICAL PROPERTIES
Thermochemical cycles: A new method of producing hydrogen
[LASL-80-26] N81-12275

THERMOCHEMISTRY
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197

THERMODYNAMIC CYCLES
The constant volume process in relation to the gas turbine as exemplified by the Karavodine engine
[WTHD-118] N81-12434

THERMODYNAMIC EFFICIENCY
Low cost, bare plate solar air collector
[DOE/R5-10143/1] N81-12605
Experimental and theoretical study of thermal performance of a hybrid solar system at Living History Farms
[DOE/CS-34136/1] N81-12606

THERMODYNAMIC PROPERTIES
Report on explosives machining
[AD-A090732] N81-12259
Measurement of the solar radiative properties of silica gel
[VKI-TM-29] N81-12635
Fundamentals and techniques of nonimaging optics for solar energy concentration
[DOE/ER-10575/1] N81-12874

THERMOELECTRIC COOLING
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
[DS-ERT-14/80] N81-12381

THERMOELECTRIC POWER GENERATION
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575

THERMOMECHANICAL TREATMENT
Influence of thermomechanical treatment on microstructure and mechanical properties of high-strength aluminum alloys
[ESA-TT-507] N81-12222

THERMOSETTING RESINS
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170

THERMOSPHERE
Nitric oxide cooling in the terrestrial thermosphere
[AERONOMICA-ACTA-A-214-1980] N81-12673
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685

THICK FILMS
Development of hybrid circuits, a summary
[ESA-CR(P)-1243-REV-B] N81-12350

THIN FILMS
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
Thin film corrosion
[BDX-613-2435] N81-12217
Fundamental limitations of electron beam lithography for future military IC fabrication
[AD-A090407] N81-12336
Comparison of metallization systems for thin film hybrid microcircuits
[BDX-613-2489] N81-12344
Large scale integrated MOS circuits with small dimensions. Preparation of thin films
[BMFT-FB-T-79-55] N81-12346
Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications
[DOE/ET-23013/T5] N81-12597
Low cost thin film polycrystalline silicon solar cells
[DOE/ET-23048/T1] N81-12603
Indium phosphide/cadmium sulfide thin-film solar cells
[SERI/PR-8170-1-T1] N81-12616
Research in multi-color thin film emitters
[AD-A090472] N81-12908
Thin-film coatings N81-12983

THREE AXIS STABILIZATION
Design of the Annular Suspension and Pointing System (ASPS) (including design addendum)
[NASA-CR-3343] N81-12158

THREE DIMENSIONAL FLOW
Sheared three dimensional flow around surface vehicles
[AAAF-NT-80-23] N81-12032

THRESHOLDS (PERCEPTION)
Some further thoughts on temporary threshold shift --- hearing and intermittent noise
[RAE-TM-FS-338] N81-12734

TIDAL FLATS
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486

TIMBER IDENTIFICATION
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492

TIMBER INVENTORY
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
Multistage variable probability forest volume inventory --- Defiance Unit of the Navajo Nation in Arizona and Colorado
[E81-10037] N81-12519

TIME DEPENDENCE
Solving the Helmholtz equation for exterior problems with variables index of refraction, 1
[AD-A090550] N81-12309

TIME DIVISION MULTIPLE ACCESS
Next generation communications satellites: Multiple access and network studies
[NASA-CR-165145] N81-12139

TIME LAG
Correlation and prediction of propagation time-delays along earth-space links
[AD-A090441] N81-12313

TIME OPTIMAL CONTROL
Optimal regulation in systems with stochastic time sampling
[NASA-TP-1743] N81-12812

TISSUES (BIOLOGY)
Effect of ionizing radiations on connective tissue
[UR-3490-1900] N81-12732

TITAN
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964

TITANIUM
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
A preliminary investigation of the behavior of titanium-lead dioxide electrodes
[ECRC/M1266] N81-12349

TITANIUM ALLOYS
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks --- hot working
[SNIAS-801-551-103] N81-12221
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452

TOPOGRAPHY
Image processing of HCMM-satellite thermal images for superposition with other satellite imagery and topographic and thematic maps --- Upper Rhine River Valley and surrounding highlands Switzerland, Germany, and France
[E81-10005] N81-12482
A method for the processing and analysis of digital terrain elevation data --- Shiprock and Gallup Quadrangles, Arizona and New Mexico
[E81-10030] N81-12512
Detection of signal signatures of cartographic features
[AD-A090375] N81-12531
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942

TOROIDAL PLASMAS
Spinning plasma ring stable to tilting mode
[IPPJ-478] N81-12884
Toroidal plasma equilibrium with gravity --- stellar magnetic fields
[PPPL-1704] N81-12895
A reactor study on a belt-shaped screw pinch --- configuration
[REPT-73-76] N81-12902

TORSIONAL STRESS
The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470

TOWERS
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877

TOWING
Aircraft towing feasibility study
[DOE/CS-50069/1] N81-12051

TOXIC HAZARDS
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660

TRACE CONTAMINANTS
Effects of several trace contaminants on fuel cell performance
[DOE/METC-RI-80-17] N81-12591

TRACE ELEMENTS
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920

TRACKING (POSITION)
Laboratory investigations of biomedical factors influencing laser designator operator performance
[AD-A090425] N81-12739

TRANSDUCERS
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390

TRANSFER FUNCTIONS
Multivariable identification using centralized fixed modes N81-12091
Multivariable synthesis with transfer functions --- applications to gas turbine engines N81-12102
Laser fusion studies at NRL
[AD-A090116] N81-12850

TRANSFORMERS
Three phase power factor controller
[NASA-CASE-MFS-25535-1] N81-12330
Non-contacting power transfer device
[NASA-CASE-GSC-12595-1] N81-12331

TRANSISTOR LOGIC
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326

TRANSITION
On the smoothness of Markov chain transition functions
[CTH-MATH-1980-5] N81-12810

TRANSITION METALS
Rigid muffin-tin approximation for the electron-phonon interaction in transition metals
[CONF-800864-1] N81-12839

TRANSITION TEMPERATURE
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229

TRANSMISSION LINES
High temperature gas-insulated systems
[EPRI-EL-1500] N81-12368
TRANSMISSIONS (MACHINE ELEMENTS)
Advanced transmission components investigation program: Bearing and seal development
[AD-A090675] N81-12075
Energy aspects of designing electric automobiles and electrical transmissions for them
[DOE-TR-229] N81-12951
TRANSMITTANCE
Description and utilization of a computation program of the optical radiation transmitted, emitted or diffused by the atmosphere for satellite observation --- spectral domain .3 to 25 microns
[ONERA-NT-1980-3] N81-12878
TRANSMITTERS
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
TRANSMUTATION
The APEX accelerator cycle for transmutation of long-lived fission wastes
[BNL-28282] N81-12861
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925
TRANSONIC FLOW
Transonic flow computations with separate treatment of the subsonic and supersonic regions
[AD-A090327] N81-12025
Multigrid technique applied to lifting transonic flow using full potential equation
[SAAB-L-0-1-B439] N81-12028
TRANSONIC SPEED
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023
TRANSPIRATION
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
TRANSPORT AIRCRAFT
Assessment of variable camber for application to transport aircraft
[NASA-CR-158430] N81-12016
Air cargo market outlook and impact via the NASA CLASS project --- Cargo/Logistics Airlift Systems Study
[NASA-TM-81886] N81-12039
Commuter air carrier loan guarantee study
[AD-A090615] N81-12047
TRANSPORT PROPERTIES
A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364
Analysis of proton transport experiments
[NRL-MR-4322] N81-12848
Computational physics program of the National MFE Computer Center
[UCID-175530-REV-1] N81-12927
TRANSPORT THEORY
Some singular integral equations in linear transport theory
[SAND-80-1069] N81-12795
TRANSPORTATION
Analysis of air quality management with emphasis on transportation sources
[NASA-CR-163746] N81-12647
TRANSPORTATION ENERGY
Development of alcohol-based synthetic transportation fuels from coal-derived synthesis gases
[DOE/ET-14858/2] N81-12266
Alternative transportation fuels
[CONF-800419-5] N81-12267
TRAPPED PARTICLES
Trapped electron modifications to tearing modes in the low collision frequency limit
[SAI-245-80-348-LJ] N81-12846
TRAPPING
Effect of a dc electric field on the trapping dynamics of a cold electron beam
[AD-A090810] N81-12888
TRAVELING WAVE TUBES
Large signal TWT computer theory
[AD-A090748] N81-12340
TREES (MATHEMATICS)
Optimal resource placement in a distributed system (extended abstract)
[AD-A090772] N81-12780
TREES (PLANTS)
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
TRIANGULATION
Selenocentric control system (1979)
[AD-A090543] N81-12969
TRIODES
Gigawatt microwave emission from a relativistic reflex triode
[AD-A090598] N81-12335
TROPICAL STORMS
A description of the NSSL cases used for a simulated VAS retrieval study
[NASA-TM-82023] N81-12678
TROPOSPHERE
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
Test and evaluation of water vapor radiometers
[NASA-CR-160043] N81-12391
TUNABLE LASERS
Line shapes in laser experiments
[AD-A090766] N81-12415
TUNGSTEN
Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904
Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915
TUNING
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405
TURBINE BLADES
An attempt to minimize secondary flow effects in a turbine
[PNR-90020] N81-12083
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
Sheared zone considerations in incompressible turbulent boundary layer calculations
[AAAF-NT-80-03] N81-12355
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
Application of model laws when determining the heat transfer coefficients by experiments on cooled turbine blades N81-12998
Studies of turbulence characteristics and their effects upon the distribution of heat transfer to turbine blading N81-13001
TURBINE ENGINES
Multivariable identification using centralized fixed modes N81-12091
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427
TURBINES
Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors and turbines N81-12994
TURBOCOMPRESSORS
Advanced industrial gas turbine techology readiness demonstration
[DOE/OR-05035/T1] N81-12426
TURBOFAN ENGINES
Low-cost directionally-solidified turbine blades, volume 2 --- TFE731-3 turbofan engine
[NASA-CR-159562] N81-12088
F100 multivariable control synthesis program: A review of full scale engine altitude tests --- F100 engine N81-12093
Engine identification for adaptive control N81-12100
Multivariable nyquest array method with application to turbofan engine control N81-12101
Sensor/actuator failure detection for turbofan engines N81-12104
TURBOGENERATORS
Stability of large horizontal-axis axisymmetric wind turbines
[NASA-TM-81623] N81-12446
TURBOJET ENGINE CONTROL
Engine identification for adaptive control N81-12100
Multivariable nyquest array method with application to turbofan engine control N81-12101
Sensor/actuator failure detection for turbofan engines N81-12104
TURBOJET ENGINES
Numerical analysis of the flow in the connecting passage between the fan section and high pressure section of a turbojet engine
[AD-A090506] N81-12107
Studying the exhaust gas from a post combustion turbojet engine N81-12996
TURBOMACHINERY
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
Heat transfer measurements related to hot turbine components in the von Karman Institute hot cascade tunnel N81-12999
TURBULENCE
Shuttle Simulation Turbulence Tapes SSTT users guide
[NASA-CR-161604] N81-12134
Experimental analysis of the boundary layer transition with zero and positive pressure gradient
[NASA-TM-75763] N81-12359
Studies of turbulence characteristics and their effects upon the distribution of heat transfer to turbine blading N81-13001
Velocity and turbulence measurements in turbulent flames using the L2F technique N81-13003
The study of turbulent diffusion flames: Modeling needs and experimental light scattering capabilities N81-13011
TURBULENCE EFFECTS
Experimental and numerical study of flow in air intakes at high incidences
[AAAF-NT-80-19] N81-12031
TURBULENCE METERS
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390
TURBULENT BOUNDARY LAYER
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
Calculations for nonstationary laminar flow subject to an average deceleration with shearing
[AAAF-NT-80-02] N81-12373
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
Electron beam measurements of the density in a hypersonic turbulent boundary layer at M = 9
[IC-AERO-80-01] N81-12378
TURBULENT DIFFUSION
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
On eddy diffusion coefficients --- in atmospheric models
[AERONOMICA-ACTA-A-212-1980] N81-12672
TURBULENT FLOW
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
Turbulent solution of the Navier-Stokes equations
[NASA-TM-81621] N81-12358

A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364
Simultaneous two dimensional measurements with one color laser Doppler velocimeter
[VKI-TM-28] N81-12383
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
Probe measurements in multi-dimensional reacting flows N81-12997
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005

TURBULENT JETS
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365

TURBULENT MIXING
Turbulent mixing and concentration measurement
[VKI-PREPRINT-1980-8] N81-12377

TWO DIMENSIONAL BODIES
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038

TWO DIMENSIONAL BOUNDARY LAYER
Boundary layer measurements on a two dimensional wing with flap and a comparison with calculations
[NLR-MP-79034-U] N81-12036
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360

TWO DIMENSIONAL FLOW
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026
Measurements in a two dimensional wake merging into a boundary layer
[NLR-TR-79063-U] N81-12034
Method for calculating two dimensional sheared flow at high Reynolds numbers --- for viscous fluids
[AAAF-NT-80-01] N81-12372
Simultaneous two dimensional measurements with one color laser Doppler velocimeter
[VKI-TM-28] N81-12383
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885

TWO PHASE FLOW
Effect of wetting layer and void fraction nonuniformity on the characteristics of a two-phase liquid-metal MHD generator
[LOG-E379] N81-12881

TWO-WAVELENGTH LASERS
High accuracy distance measurement by two-wavelength pulsed laser source
[CISE-N-189] N81-12419

TYPHOONS
Further study of the variability in the frequency of typhoon formation over the West Pacific ocean
[COO-1340-75] N81-12702

U

U.S.S.R.
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Key issues in US-USSR scientific exchanges and technology transfer
[GPO-50-111] N81-12946

ULTRASONIC CLEANING
Acoustic tooth cleaner
[NASA-CASE-LAR-12471-1] N81-12724

ULTRASONIC FLAW DETECTION
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440

ULTRASONIC WELDING
Ultrasonic seam welding
[BDX-613-2444] N81-12431

ULTRASONICS
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212

ULTRAVIOLET RADIATION
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200
Description and utilization of a computation program of the optical radiation transmitted, emitted or diffused by the atmosphere for satellite observation --- spectral domain .3 to 25 microns
[ONERA-NT-1980-3] N81-12878
Experiments on the effect of ultraviolet on contamination in vacuum systems
[NASA-TM-81999] N81-12976

ULTRAVIOLET SPECTROSCOPY
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722
The application of UV spectroscopy to the qualtitative analysis of nitrogen oxide N81-13008

UNDERWATER COMMUNICATION
Research in progress: Antennas, Propagation and Digital Image Processing Group (APDIP) N81-12317

UNDERWATER ENGINEERING
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556

UNIONS (CONNECTORS)
Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283

UNITED STATES OF AMERICA
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
The foundations of United States information policy
[PB80-204019] N81-12933
United States civilian space policy
[GPO-66-883] N81-12941

UNITS OF MEASUREMENT
Noise measurements and the dB --- errors
[RAE-TM-FS-348] N81-12827

UNSTEADY FLOW
A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018
Unsteady aerodynamics inputs for aeroelastic analyses. Part A: A general introduction. Part B: Prediction of the unsteady airloads on oscillating lifting systems and bodies in subsonic and supersonic flow
[DFVLR-MITT-80-01] N81-12035
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433

UPPER ATMOSPHERE
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B
[RAE-TR-80052] N81-12693
Impulsive penetration of solar wind plasma and its effects on the upper atmosphere
[AERONOMICA-ACTA-A-207-1979] N81-12971

UPPER SURFACE BLOWN FLAPS
A computer program to calculate the longitudinal aerodynamic characteristics of upper-surface-blown wing-flap configurations
[NASA-CR-3005] N81-12014

UPWELLING WATER
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703

URANIUM FLUORIDES
A study of the collisional dynamics for collisions of UF with atoms and molecules
[AD-A090496] N81-12831

URBAN DEVELOPMENT
Solar envelope zoning: Application to the city planning process. Los Angeles case study
[SERI/SP-98156-1] N81-12952

URBAN RESEARCH
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484

USER MANUALS (COMPUTER PROGRAMS)
A computer program to calculate the longitudinal aerodynamic characteristics of upper-surface-blown wing-flap configurations
[NASA-CR-3005] N81-12014
User's manual for large-scale integrated circuit layout check program
[NASA-TM-78192] N81-12325
Earth Observations Division version of the Laboratory for Applications of Remote Sensing System (EOD-LARSYS) user guide for the IBM 370/148. Volume 2: User reference manual
[E81-10010] N81-12487
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
[NASA-TP-1563] N81-12744
Reference manual for the ADA programming language, proposed standard document
[AD-A090709] N81-12768

USER REQUIREMENTS
OPTIM III: A NASTRAN compatible large scale automated minimum weight design problem. Users and programmers manual
[AD-A090334] N81-12458

UTILITIES
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618

V

V/STOL AIRCRAFT
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026

VACANCIES (CRYSTAL DEFECTS)
Simulation of the structure of vacancies in high angle grain boundaries
[COO-5002-10] N81-12919

VACUUM
Insulation development for high-temperature batteries for electric vehicle application
[CONS-5160-T1] N81-12571

VACUUM APPARATUS
Experiments on the effect of ultraviolet on contamination in vacuum systems
[NASA-TM-81999] N81-12976

VACUUM SPECTROSCOPY
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200

VACUUM SYSTEMS
Water vapor pressure gauge --- vacuum systems apparatus
[BNL-28267] N81-12399
Experiments on the effect of ultraviolet on contamination in vacuum systems
[NASA-TM-81999] N81-12976

VACUUM TUBES
Axial compression testing of vacuum tube glass ceramic/molybdenum frames
[GEPP-TIS-503] N81-12238
Microstructure examination of the interface of the glass-ceramic insulator of the molybdenum frame of a vacuum tube
[GEPP-TIS-516] N81-12239

VAN DE GRAAFF ACCELERATORS
The CISE tandem vandeGraaf accelerator and its fields of use
[CISE-N-191] N81-12820

VANADIUM
Planetary-wave behavior and arctic air pollution
[DOE/EV-01340/T2] N81-12657

VANADIUM ALLOYS
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432

W

VAPOR PHASES
The vapor phase autoxidation of unsymmetrical dimethylhydrazine and 50 percent unsymmetrical dimethylhydrazine 50 percent hydrazine mixtures
[AD-A090281] N81-12261
VAPOR PRESSURE
Evaporation by mechanical vapor recompression
[BSDF-38-3Q-80] N81-12195
Water vapor pressure gauge --- vacuum systems apparatus
[BNL-28267] N81-12399
VARIABILITY
A global model of the neutral thermosphere in magnetic coordinates based on AE-C data
[NASA-CR-163796] N81-12684
VARIABLE STREAM CONTROL ENGINES
Design of a multivariable integrated control for a supersonic propulsion system --- variable stream control engine N81-12094
VARIANCE (STATISTICS)
Stratum variance estimation for sample allocation in crop surveys --- Great Plains Corridor
[E81-10035] N81-12517
VARIATIONAL PRINCIPLES
Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467
VARIATIONS
A method for measuring short time response by determining velocity and temperature variations in high temperature flows N81-13005
VEGETATION
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
VEGETATION GROWTH
A digital systematic classification of ecosystems with an illustrated summary of the natural vegetation of North America
[PB80-194020] N81-12532
VEHICULAR TRACKS
A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424
VELOCITY DISTRIBUTION
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
VELOCITY MEASUREMENT
Simultaneous two dimensional measurements with one color laser Doppler velocimeter
[VKI-TM-28] N81-12383
Probe measurements in multi-dimensional reacting flows N81-12997
Correlation measurement of velocity and temperature fluctuations in a free jet diffusion flame N81-13002
Velocity and turbulence measurements in turbulent flames using the L2F technique N81-13003
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004
Velocity and temperature measurements in a premixed flame within an axisymmetric combustor N81-13006
VERBAL COMMUNICATION
Experiments on speech recognition by linear prediction
[ENST-C-79020] N81-12782
VERMONT
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492
VERY LONG BASE INTERFEROMETRY
Test and evaluation of water vapor radiometers
[NASA-CR-160043] N81-12391
Crustal dynamics project observing plan for highly mobile systems 1981 - 1986
[NASA-TM-82029] N81-12680
VIBRATION
On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212
Development of CO2 laser Doppler instrumentation for detection of clear air turbulence, volume 2: Appendices
[NASA-CR-161610] N81-12698
VIBRATION MEASUREMENT
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877
VIBRATION TESTS
Test and analyses of an active flutter suppression system on an FFDL model of YF17 N81-12118
Spacecraft structural acoustic studies. Investigation, interpretation, and simulation of the effects of configuration features on noise. Induced structural vibration and sound transmission characteristics
[BAE-ESA/B44/40013] N81-12472
VIDEO DATA
Wideband multiplex system
[AD-A090770] N81-12312
VIDEO EQUIPMENT
Tactical video display
[AD-A089992] N81-12302
VISCOPLASTICITY
Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450
VISCOUS FLOW
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382
VISIBILITY
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536
Optical and atmospheric optical parameters during visibility tests in the north of Germany, 1977
[ESA-TT-615] N81-12690
VISUAL PERCEPTION
Visual scene perception in manual control
[NLR-MP-79045-U] N81-12743
VISUAL TASKS
Visual scene perception in manual control
[NLR-MP-79045-U] N81-12743
VLASOV EQUATIONS
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12897
VOICE COMMUNICATION
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech
[RAE-TM-FS-334] N81-12737
VOICE DATA PROCESSING
Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725
VOLCANOES
The motion and dispersion of volcanic emissions from La Soufriere injected into the stratosphere
[NASA-CR-163788] N81-12675
VOLTMETERS
Data acquisition from a digital voltmeter using a CBM PET 2001 microcomputer with particular reference to microelectronic wire bond testing
[AWRE-O-16/80] N81-12753
VORTICES
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
OTEC cold water pipe design for problems caused by vortex-excited oscillations
[NRL-MR-4157] N81-12556
The use of the finite element method in meteorological modelling
[AD-A090761] N81-12700
VOYAGER PROJECT
Voyager encounters Saturn: Scientific highlights
[NASA-NEWS-RELEASE-80-192] N81-12964
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
WAFERS
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942
WAKES
Measurements in a two dimensional wake merging into a boundary layer
[NLR-TR-79063-U] N81-12034
WALL JETS
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360
WALL TEMPERATURE
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
Curved film cooling admission tube
[NASA-CASE-LEW-13174-1] N81-12363
WALLS
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586
WASTE DISPOSAL
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
Proposed rulemaking on the storage and disposal of nuclear waste. Cross statement of the United States Department of Energy
[DOE/NE-0007-SUPPL-1] N81-12855
WASTE ENERGY UTILIZATION
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
WASTE TREATMENT
State-of-the-art report on low-level radioactive waste treatment
[ORNL/TM-7427] N81-12858
The APEX accelerator cycle for transmutation of long-lived fission wastes
[BNL-28282] N81-12861
WASTE UTILIZATION
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
Agricultural waste products as alternative energy sources
[GPO-62-991] N81-12561
Energy from municipal solid wastes
[GPO-61-252] N81-12566
Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
WATER
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
WATER HEATING
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
Solar hot water space heating system
[DOE/CS-34412/18] N81-12584
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604
Environmental assessment: Geothermal direct heat project, Marlin, Texas
[DOE/EA-0117] N81-12655
WATER POLLUTION
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
WATER QUALITY
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data --- Alabama, Georgia, Kentucky, Tennessee, and North Carolina
[E81-10008] N81-12485
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492

WATER RECLAMATION
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
WATER RESOURCES
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
Heat Capacity Mapping Mission (HCMM)
[E81-10020] N81-12497
Heat Capacity Mapping Mission (HCMM)
[E81-10021] N81-12498
Remote Sensing For Water Resources And Hydrology. Recommended research emphasis for the 1980's
[NASA-CR-163791] N81-12529
The impact of an accelerated coal-based synfuels program on western water resources
[GPO-61-316] N81-12649
WATER TABLES
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Synergistic relationships among remote-sensing and geophysical media: Geological and hydrological applications N81-12508
WATER TEMPERATURE
Shoreline as a controlling factor in commercial shrimp production
[E81-10009] N81-12486
WATER TREATMENT
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
WATER VAPOR
Water vapor pressure gauge --- vacuum systems apparatus
[BNL-28267] N81-12399
WATER WAVES
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
WATERSHEDS
The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas --- Bridge Creek fire area, Deschutes National Forest, Oregon
[E81-10014] N81-12491
Remote sensing program activity report --- Vermont
[E81-10015] N81-12492
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
WATERWAVE ENERGY
Wave power extraction from a transient heaving cylinder
[DOE/ET-21019/T1] N81-12599
WAVE ATTENUATION
Effects of ionospheric reflection height and ground conductivity on earth-ionosphere waveguide mode and ground-wave attenuation rates
[AD-A090716] N81-12686
WAVE DISPERSION
Parametric acoustic conversion-efficiency enhancement via boundary induced and inherent dispersivity
[AD-A090329] N81-12823
WAVE EQUATIONS
Solving the Helmholtz equation for exterior problems with variables index of refraction, 1
[AD-A090550] N81-12309
Asymptotic behavior for a strongly damped nonlinear wave equation
[AD-A090548] N81-12814
WAVE EXCITATION
Wave power extraction from a transient heaving cylinder
[DOE/ET-21019/T1] N81-12599
WAVE INTERACTION
Large signal TWT computer theory
[AD-A090748] N81-12340
WAVE PACKETS
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853
WAVE PROPAGATION
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
Numerical resolution of diffusion and propagation problems in the parabolic approximation context --- pressure field
[ONERA-P-1978-5] N81-12318
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
Thickening of a shock front by the grain structure of a solid
[LA-8410-MS] N81-12369
Spatial coherence and intensity properties of quasihomogeneous optical sources
[AD-A090378] N81-12413
Surface nonlinear optics
[LBL-11252] N81-12875
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885
Wave propagation in a temperate plasma having n ions species
[IPF-78-7] N81-12899
Super-alfvenic propagation of cosmic rays: The role of streaming modes
[NASA-TM-82032] N81-12975
WAVE SCATTERING
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872
WAVEFORMS
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
Acoustoelectric devices: A new technology for waveform-agile radar
[AD-A090646] N81-12311
WAVEGUIDES
Multi-mode horn antenna simulation
[NASA-TM-80705] N81-12298
Developments in United Kingdom waveguide power standards
[RSRE-80006] N81-12319
WAVELENGTHS
Vector analogues of the Maggi-Rubinowicz theory of edge diffraction
[NASA-TM-82024] N81-12297
WEAR
The use of ion implantation for materials processing
[AD-A090714] N81-12903
WEAR TESTS
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226
Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C --- air breathing engines
[NASA-CR-159794] N81-12227
WEATHER FORECASTING
A description of the NSSL cases used for a simulated VAS retrieval study
[NASA-TM-82023] N81-12678
A simulation study on the impact of satellite sensed winds on tropical cyclone forecast
[AD-A090322] N81-12699
Fog prediction. Citations from the NTIS data base
[PB80-813959] N81-12715
WEATHER STATIONS
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
WEIGHTING FUNCTIONS
OPTIM III: A NASTRAN compatible large scale automated minimum weight design problem. Users and programmers manual
[AD-A090334] N81-12458
WEIGHTLESSNESS
Materials processing in space: Future technology trends N81-12991
WELD TESTS
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432
WELDING
Effects of xenon cover gas in CO2 laser welding
[BDX-613-2442] N81-12430
WETLANDS
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data --- New Orleans, Louisiana
[E81-10007] N81-12484
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
WETTING
Effect of wetting layer and void fraction nonuniformity on the characteristics of a two-phase liquid-metal MHD generator
[LOG-E379] N81-12881
WHEAT
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
Effects of management practices on reflectance of spring wheat canopies --- Williston, North Dakota Agricultural Experiment Station
[E81-10019] N81-12496
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Illustration of year-to-year variation in wheat spectral profile crop growth curves --- Kansas, Oklahoma, North Dakota and South Dakota
[E81-10032] N81-12514
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Stratum variance estimation for sample allocation in crop surveys --- Great Plains Corridor
[E81-10035] N81-12517
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
WHITE DWARF STARS
White dwarf models for type 1 supernovae and quiet supernovae, and presupernova evolution
[NASA-TM-82030] N81-12957
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
WILDLIFE
Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) --- Oregon
[E81-10013] N81-12490
WIND (METEOROLOGY)
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
WIND MEASUREMENT
Tracking of smokestack and cooling tower plumes using wind measurements at different levels
[ORNL/TM-7417] N81-12654
WIND PROFILES
Effect of rawinsonde errors on rocketsonde density and pressure profiles: An error analysis of the Rawinsonde System
[NASA-CR-156873] N81-12677
WIND SHEAR
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
Simulation comparison of a decoupled longitudinal control system and a velocity vector control wheel steering system during landings in wind shear
[NASA-TP-1734] N81-12109
WIND TUNNEL CALIBRATION
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
A comparison of methods for calibration and use of multi-component strain gauge wind tunnel balances
[AD-A090484] N81-12394

WIND TUNNEL MODELS
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
Synthesis of test results obtained with Concorde at high incidences
[AAAF-NT-80-26] N81-12079
WIND TUNNEL TESTS
Low-speed aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications
[NASA-TP-1498] N81-12015
Experiments on an airfoil at high incidence in plunging motion
[AAAF-NT-80-09] N81-12030
Measurements in a two dimensional wake merging into a boundary layer
[NLR-TR-79063-U] N81-12034
Low-speed aerodynamic performance of 50.8 centimeter-diameter noise-suppressing inlets for the Quiet, Clean, Short-haul Experimental Engine (QCSEE) --- Lewis 9 by 15 foot low speed wind tunnel tests
[NASA-TP-1178] N81-12084
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort
N81-12116
Wind tunnel tests on a fighter aircraft wing/store flutter suppression system: The B.Ae control law
N81-12119
Modeling and control of transonic cryogenic wind tunnel: A summary report
[NASA-CR-159376] N81-12121
Three component measurements on a body with various afterbody configurations in subsonic and transonic flow
[ESA-TT-628] N81-12151
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8 --- Langley transonic dynamics tunnel tests
[NASA-TM-81863] N81-12448
WIND TUNNELS
Active control of an explosive wing-store flutter case --- Langley Research Center N81-12117
WIND VELOCITY
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B
[RAE-TR-80052] N81-12693
WINDMILLS (WINDPOWERED MACHINES)
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
Application of a method for aerodynamic analysis and design of horizontal axis wind turbines, part 1
[FFA-TN-AU-1499-PT-1] N81-12633
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
Large wind turbines: A utility option for the generation of electricity N81-12981
WINDOWS (APERTURES)
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444
WINDPOWER UTILIZATION
Stability of large horizontal-axis axisymmetric wind turbines
[NASA-TM-81623] N81-12446
Wind energy systems: Program summary
[DOE/CS-20097/01] N81-12580
Reliability, energy, and cost effects of wind powered generation integrated with a conventional generating system
[ANL/AA-17] N81-12621
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
WINDPOWERED GENERATORS
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
WING FLAPS
Boundary layer measurements on a two dimensional wing with flap and a comparison with calculations
[NLR-MP-79034-U] N81-12036
WING LOADING
Assessment of variable camber for application to transport aircraft
[NASA-CR-158430] N81-12016
Unsteady aerodynamics inputs for aeroelastic analyses. Part A: A general introduction. Part B: Prediction of the unsteady airloads on oscillating lifting systems and bodies in subsonic and supersonic flow
[DFVLR-MITT-80-01] N81-12035
WING PLANFORMS
Induced drag ideal efficiency factor of arbitrary lateral-vertical wing forms
[NASA-CR-3357] N81-12022
WING TANKS
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort
N81-12116
Active control of an explosive wing-store flutter case --- Langley Research Center N81-12117
Wind tunnel tests on a fighter aircraft wing/store flutter suppression system: The B.Ae control law
N81-12119
WING TIPS
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
WINGLETS
Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
Induced drag ideal efficiency factor of arbitrary lateral-vertical wing forms
[NASA-CR-3357] N81-12022
WINGS
Low drag airfoil design utilizing passive laminar flow and coupled diffusion control techniques
[AD-A090778] N81-12024
Aircraft accident report: Allegheny Airlines, Inc., Nord 262, Mohawk/Frakes 298, n29824, Benedum Airport, Clarksburg, West Virginia, February 12, 1979
[NTSB-AAR-79-12] N81-12044
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077
Aeroelastic optimization with multiple constraints
[AD-A090775] N81-12451
WINTER
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report
N81-12709
WISCONSIN
For multidisciplinary research on the application of remote sensing to water resources problems --- including crop yield, watershed soils, and vegetation mapping in Wisconsin
[E81-10017] N81-12494
WOOD
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
WORLD METEOROLOGICAL ORGANIZATION
Technical regulations: Hydrology and international hydrological codes
[WMO-555] N81-12540
Study of the operational deployment of SIRIO-2 ground stations, volume 3 --- meteorological data distribution
[ESA-CR(P)-1369-VOL-3] N81-12713
Manual on the global data processing system. Volume 2: Regional aspects --- World Meteorological Organization
[WMO-485-VOL-2] N81-12714
WORMS
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707

X

X RAY ASTRONOMY
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958
An X-ray survey of nine historical novae --- HEAO 2 observations
[NASA-TM-82014] N81-12961
X RAY DIFFRACTION
Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256
Synchrotron radiation sources for photobiology and ultraviolet, visible and infrared spectroscopy
[BNL-28149] N81-12722
Czochralski growth of single-crystal gehlenite Ca2Al2SiO7
[CONF-800908-2] N81-12921
X RAY FLUORESCENCE
X-ray fluorescence analysis of metal concentration in an alloy electroplating bath
[BDX-613-2411] N81-12205
The CISE tandem vandeGraaf accelerator and its fields of use
[CISE-N-191] N81-12820
X RAY IMAGERY
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942
X RAY SPECTRA
On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
X RAYS
X-ray holography with X-rays
[AD-A090807] N81-12393
XENON
Effects of xenon cover gas in CO2 laser welding
[BDX-613-2442] N81-12430

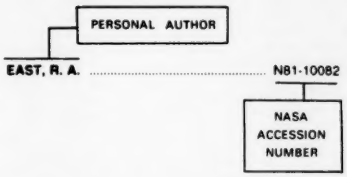
Y

YAW
The flying qualities of aircraft with actively augmented pitch and yaw stability
[ARC-R/M-3848] N81-12113
YF-12 AIRCRAFT
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067
YIELD
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans --- U.S. Corn Belti Indiana and Iowa
[E81-10027] N81-12504
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513

Z

ZIRCONATES
Microstructure and domain structure of PZT --- piezoelectric materials
[LBL-10651] N81-12917
ZIRCONIUM
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211

Typical Personal Author Index Listing



Listings in this Index are arranged alphabetically by personal author. The NASA accession number denotes the number by which the citation is identified.

A

AAMODT, R. E. N81-12893
ABBOTT, J. M. N81-12084
ABE, T. N81-12886
ABRAHAMSON, K. R. N81-12788
ABRIAL, J. R. N81-12768
ACKERMAN, M. N81-12674
ADAMS, G. J. N81-12577
ADAMS, R. R. N81-12388
AGUIERA, R. A. N81-12869
AHMADI, H. K. N81-12139
AHN, B. H. N81-12906
ALBANESE, A. S. N81-12203
ALEXANDER, C. J. N81-12491
ALEXANDER, P. M. N81-12305
ALLEN, B. N81-12687
ALLEN, J. E., JR. N81-12679
ALLEY, B. J. N81-12256
ALLSUP, J. R. N81-12270
ALMGREN, D. W. N81-12564
ALSTER, J. N81-12264
ALSTON, T. G. N81-12279
ALTMAN, K. I. N81-12732
ALWANG, W. G. N81-12994
AMOS, D. E. N81-12796
ANCHEV, V. K. N81-12212
ANDERSON, C. D. N81-12726
ANDERSON, D. L. N81-12067
ANDERSON, J. E. N81-12519
ANDRESS, B. N81-12236
ANGELIS, A. L. S. N81-12840
ANTOLOVICH, S. D. N81-12453
ARDAI, J. N81-12687
ARGYRIS, J. H. N81-12626
N81-12627
N81-12628
ARLINGER, B. N81-12028
ARNAL, D. N81-12359
ARNETT, E. M. N81-12100
ASKEW, W. S. N81-12267
ASSASSA, G. M. N81-12355
ASSINK, R. A. N81-12242
N81-12243
ATTAL, B. N81-13009
AUCOIN, P. J. N81-12487
AUCOIN, T. R. N81-12333
N81-12905
AVILA, J. H. N81-12071

B

BACON, D. P. N81-12857
BADER, R. M. N81-12463
BAGGI, D. L. N81-12763
BAHU, M. N81-12650
BAILEY, M. G. N81-12770
BAILEY, W. H., JR. N81-12020
BAIN, R. L. N81-12273
BAINBRIDGE, H. N81-12692
BAKER, G. K. N81-12246
BALADI, G. Y. N81-12424
BALAKRISHNA, S. N81-12120
N81-12121
BALDWIN, D. H. N81-12981
BALDWIN, R. M. N81-12273
BALL, F. L. N81-12921
BALL, H. N81-12643
BALLATO, A. T. N81-12332
N81-12336
BALLE, J. N81-12752
BANKS, H. T. N81-12728
BARBER, T. A. N81-12987
BARET, F. N81-12535
BARKATS, G. N81-12150
BARNES, J. G. P. N81-12768
BARRETT, C. A. N81-12211
BARTEL, C. N81-12644
N81-12645
BARTELDS, G. N81-12802
BARTER, N. J. N81-12991
BARTLETT, R. P. N81-12378
BASILI, V. R. N81-12767
BATES, J. B. N81-12921
BATTEN, L. G. N81-12508
BAUER, E. K. N81-12588
BAUER, M. E. N81-12496
N81-12504
BAUMANN, P. R. N81-12484
BAXTER, D. C. N81-12883
BAY, J. N81-12297
BAYLEY, F. J. N81-13001
BAYLIN, F. N81-12576
BAYMAN, B. F. N81-12853
BEAHY, V. R. N81-12338
BEASLEY, W. D. N81-12015
BEATRICE, E. S. N81-12739
BEATTIE, E. C. N81-12094
BEATTY, D. E. N81-12143
BEATTY, G. H. N81-12213
BEAURAIN, L. N81-12111
BECK, M. S. N81-12218
BECKER, P. J. N81-12931
BECKER, R. H. N81-12961
BEHBEHANI, K. N81-12104
BELGIN, M. F. N81-12338
BELINA, F. W. N81-12047
BELL, C. H. N81-12862
BELLET, J. C. N81-13008
BELLINA, C. R. N81-12731
BELLUOMO, P. N81-12522
BENECCHI, S. N81-13012
BENGTSSON, H. N81-12465
BENHANNON, K. W. N81-12963
BENNETT, F. C. N81-12620
BENNETT, H. X. N81-12180
BENNETT, W. A. N81-12108
BENNY, A. H. N81-12539
BERGMAN, B. N81-12438
N81-12804
BERGSTRA, J. A. N81-12799
BERMAN, P. R. N81-12415
BERNARD, A. N81-12159
BERNARD, M. L. N81-12281
BERNSTEIN, I. B. N81-12892
BERTONI, E. A. N81-12130
BESCH, H. J. N81-12840
BEST, R. N81-12381
BEST, R. G. N81-12511
BEVERLY, R. E., III N81-12560
BEZAUD, C. N81-12220
BHAVNANI, K. H. N81-12141
BIEBER, A. M., JR. N81-12860
BIEGEL, J. N81-12163
BIEMANN, W. N81-12381
BILL, R. C. N81-12210
BINDER, G. N81-12373
BLACK, C. J. N81-12754
BLAKE, J. B. N81-12683
BLAUNER, P. G. N81-12848
BLAVY, A. A. N81-12052
BLAZEK, R. J. N81-12219
BLOOMFIELD, H. S. N81-12988
BLUMENFELD, B. J. N81-12840
BOBICK, J. C. N81-12049
BOBROWICZ, F. N81-12414
BODAMER, G. W. N81-12954
BODNER, S. N81-12850
BOISSARD, P. N81-12522
BOLDT, E. A. N81-12958
BOLLE, H. N81-12931
BOLT, C. R. N81-12087
BOOK, D. N81-12850
BOOKER, M. K. N81-12214
BORENSTEIN, S. R. N81-12876
BORGHI, R. N81-12207
BORIS, J. N81-12850
BORREGO, C. N81-12377
N81-12383
N81-13015
BOSCH, R. N81-12381
BOSMA, J. N81-12251
BOTTS, T. N81-12861
BOUBEL, R. W. N81-12851
BOUCHARDY, A. M. N81-12878
BOURREAU, A. N81-12281
BOWDEN, C. M. N81-12865
BOYD, W. A. N81-12280
BOYER, R. N81-12098
BRADY, G. N81-12668
BRAMSON, B. D. N81-12771
BRANCA, G. C. N81-12954
BRANDT, B. N81-12902
BRANDT, H. E. N81-12335
BRANOVER, H. N81-12881
BRASSER, L. N81-12664
BRASSEUR, G. N81-12672
BRAUN, G. W. N81-12572
BRAUN, K. A. N81-12626
N81-12627
N81-12628
BREUGELMANS, F. A. E. N81-12433
BREVES, E. O. N81-12164
BRIDGES, P. D. N81-12019
BRIERLEY, D. H. N81-12825
BRIOSCHI, C. N81-13014
BRISTOWE, P. D. N81-12919
BROMBORSKY, A. N81-12335
BROOKS, J. J. N81-12191
BROWN, D. B. N81-12911
N81-12912
BROWN, D. E. N81-12532
BROWN, P. W. N81-12012
BROWN, R. W. N81-12828
BROWNLEE, J. A. N81-12019
BRUBAKER, K. L. N81-12705
BRUCE, C. W. N81-12411
BRUCE, D. N81-12411
BRUNS, H. B. N81-12335
BRUNSCH, M. N81-12078
BRZEZINSKI, A. N81-12384
BRZEZINSKI, J. N81-12816
BUCHLIN, J. M. N81-13004
BUCKINGHAM, I. P. N81-12729
BUCKLEY, D. H. N81-12983
BUCKWALTER, C. Q. N81-12609
BUDILLON N81-12221

BUEHRING, W. A. N81-12621
BUGEAT, J. P. N81-12165
BUNK, W. N81-12222
BURATTI, A. N81-12166
BURKE, W. R. N81-12631
N81-12992
BURKET, H. N81-12411
BURKHEAD, M. S. N81-12960
BURLAGA, L. F. N81-12965
N81-12968
BURNS, D. A. N81-12663
BUSER, R. G. N81-12412
BUSH, C. C. N81-12027
BUSH, H. G. N81-12445
BUSHKIN, A. A. N81-12933
BUSSOLINO, L. N81-12379
BUSTRAAN, M. N81-12902
BUTLER, W. H. N81-12839
BUXAUM, O. N81-12464
BUXBAUM, S. R. N81-12440

C

CAFARELLA, J. H. N81-12311
CALVIN, M. N81-12842
CAMARDA, C. J. N81-12173
N81-12362
CAMILLERI, L. N81-12840
CAMMACK, L. N81-12357
CAMPBELL, T. G. N81-12155
CANDEL, S. N81-12318
CARADONNA, F. X. N81-12018
CARLIN, C. M. N81-12097
CARLSON, O. N. N81-12218
CARLSON, T. N. N81-12502
CARNEBIANCA, C. N81-12166
CARON, P. R. N81-12304
CARPENTER, T. N. N81-12930
CARREAU, J. L. N81-12281
CARRIGAN, B. N81-12421
N81-12784
N81-12785
CARROLL, B. D. N81-12326
CARTWRIGHT, D. J. N81-12469
CARUSO, E. N81-12820
CASE, G. L. N81-12578
CASH, H. R. N81-12954
CASKEY, J. F. N81-12658
CASPERSSON, S. A. N81-12265
CASSANET, J. N81-12501
CATTO, P. J. N81-12846
N81-12892
N81-12893
N81-12894
CAVAGNARO, D. M. N81-12253
N81-12254
N81-12640
N81-12641
N81-12665
N81-12666
CAVANAUGH, D. B. N81-12866
CHALLITA, A. N81-12050
CHAMIS, C. C. N81-12171
CHAMPION, R. D. N81-12831
CHANG, S. K. N81-12308
CHANG, S. W. N81-12699
CHANTERANNE, J. N81-12221
N81-12247
CHAO, K. K. N. N81-12803
CHAPIN, T. J. N81-12840
CHAPMAN, M. N81-12428
CHARDENEL, M. N81-13005
CHARPIN, D. N81-12373
CHEN, C. H. N81-12764
CHEN, C. K. N81-12675
CHEN, P. F. N81-12531
CHERNIAVSKY, V. N81-12781
CHESNE N81-12350
CHESTER, D. N81-12766
CHEW, Y. T. N81-12366
CHHIKARA, R. S. N81-12516
N81-12517
CHIVERS, J. W. H. N81-12029
CHOATE, W. W. N81-12650
CHOI, C. S. N81-12443
CHOMETON, F. N81-12032
CHOW, E. Y. N81-12439
CHRASTINA, J. R. N81-12954
CHRISTENSEN, K. L. N81-12161
CHRYSSAFI, S. N81-12467
CHUNG, D. M. N81-12807
CIESIELSKI, P. E. N81-12703
CIGNOLI, F. N81-13012
CIHLAR, J. N81-12499
CLARK, F. S. N81-12227
CLINE, J. E. N81-12074
COCHRAN, R. P. N81-12089
COCKS, F. H. N81-12215
COGGER, M. K. N81-12320
COGHE, A. N81-13014
COHEN, R. E. N81-12230
COLE, A. E. N81-12130
COLE, J. E. N81-12258
COLEMAN, A. J. N81-12569
COLEMAN, J. J. N81-12410
COLLARD, D. N81-12079
COLLETT, E. N81-12413
CONANT, M. A. N81-12557
CONE, M. L. N81-12914
CONNER, D. W. N81-12039
CONNOLLY, G. F. N81-12067
CONNOR, L. N. N81-12635
COOK, C. F., JR. N81-12336
COOL, R. L. N81-12837
N81-12840
COOPERSTEIN, G. N81-12848
N81-12857
COPELAND, R. J. N81-12575
CORBIN, N. D. N81-12870
CORDES, W. N81-12237
COULURIS, G. J. N81-12049
COURANT, E. D. N81-12852
COURY, G. E. N81-12195
N81-12604
COX, B. N81-12843
COX, G. W. N81-12326
COX, K. E. N81-12275
CRECELIUS, D. W. N81-12496
CREPANI, E. N81-12500
CREPON, M. N81-12501
CREYF, H. N81-12235
CRISTOFORI, F. N81-12820
CRONIN, J. N81-12368
CROONQUIST, A. N81-12357
CROSS, E. J., JR. N81-12019
CSIGI, K. I. N81-12564
CUMMINGS, I. M. N81-12932
CUMMINS, R. J. N81-12472
CUNNINGHAM, D. N81-12158
CUNNOLD, D. N81-12675
CURTIS, S. A. N81-12682
CUTHBERT, B. N. N81-12727

D

DAHIYA, R. C. N81-12806
DAHL, G. N81-12063
DALE, B. J. N81-12458
DALSTED, K. J. N81-12511
DAMATO, R. N81-12056
DAMBRA, F. N81-12182
DAMMS, S. M. N81-12468
DAMSTRA, G. C. N81-12902
DANIEL, J. L. N81-12609
DAPKUS, P. D. N81-12410
DARAGONA, F. S. N81-12602
DARNER, G. S. N81-12431
DAS, M. B. N81-12597
DATZ, S. N81-12922
DAUBE, O. N81-12374
DAUGHTRY, C. S. T. N81-12496
DAVIES, R. L. N81-12982
DAVIS, G. A. N81-12913
DAVIS, W. S. N81-12907
DAVITIAN, H. N81-12612
N81-12613
DAWES, J. B. N81-12282
DEACETIS, L. A. N81-12303
DEAL, P. L. N81-12012
N81-12043
DECASTRO, A. R. B. N81-12875
DECOSTE, R. N81-12850
DEGIORGIO, V. N81-12371
DEGREY, S. P. N81-12949
DEHNE, H. J. N81-12653
DEISSLER, R. G. N81-12358
DEJESUSPARADA, N. N81-12500
DEKONING, A. U. N81-12802
DELPAPA, C. N81-12640
DELUCCIA, J. J. N81-12474
DELVO, P. N81-12403
DENNEHY, G. N81-12595
DENNIS, R. E. N81-12088
DESCHAMPS, P. Y. N81-12501
DESTUYNDER, R. N81-12118
DETHLEFSEN, R. N81-12368
DEVILLARD, R. N81-12521
DEVRIES, M. E. N81-12511
DEW, M. N81-12353
DEWAN, E. M. N81-12364
DEWAR, M. J. S. N81-12264
DEYO, J. N. N81-12990
DEYOUNG, J. N81-12022
DIEBOLD, J. N81-12196
DIEDRICH, J. H. N81-12084
DILELLA, L. N81-12840
DIMCOVSKI, Z. N81-12840
DING, Y. H. N81-12702
DIPIPPO, R. N81-12579
DIPPOLITO, D. A. N81-12890
DIVITA, E. N81-12647
DIXON, S. N81-12337
DOD, L. R. N81-12298
DODDS, R. O. N81-12213
DOGGETT, R. V., JR. N81-12448
DOSAJ, V. D. N81-12551
DOSCHER, T. M. N81-12533
DOVERSPIKE, L. D. N81-12831
DRABO, M. J. N81-12457
DRIEDONKS, A. G. M. N81-12706
DRURY, J. S. N81-12660
DUBAN N81-12350
DUDA, R. O. N81-12530
DUFFY, T. G. N81-12191
DUHAMEL, T. N81-12159
DUNCAN, C. E. N81-12730
DUNHAM, E. W. N81-12480
DUNLOP, D. D. N81-12767
DUPUIS, R. D. N81-12410
DURAND, J. P. N81-13008
DURHAM, T. A. N81-12020
DURRILL, D. C. N81-12851
DZIOBKOWSKI, C. T. N81-12911
N81-12912

E

EARL, G. F. N81-12299
EATOCK, B. C. N81-12729
ECKBREITH, A. C. N81-13010
EDELMAN, R. B. N81-12192
EDELSON, E. N81-12662
EDGE, T. M. N81-12760
EDSON, R. T. N81-12688
EDWARDS, D., JR. N81-12399
EICKHOFF, H. N81-13003
EIDENSHINK, J. C. N81-12511
EIKELBOOM, M. N81-12250
EISEN, Y. N81-12844
ELKINS, W. N81-12577
ELLING, D. N81-12237
ELLISON, J. E. N81-12568
ELSTON, S. B. N81-12838
ELWORTH, C. L. N81-12726
EMERY, J. D. N81-12794
EMERY, M. N81-12850
ENGEL, H. N81-12781
ENGLER, N. A. N81-12135
N81-12136
N81-12137
N81-12138
ENGLISH, T. D. N81-12647
ENSMINGER, J. T. N81-12660
ERNOULT, M. N81-12826
EVANS, J. C., JR. N81-12542
EVANS, L. S. N81-12661
EVERETT, R. N81-12632
EXALTO, R. N81-12249

F

FAHY, J. E. N81-12823
FALEH, M. N81-12281
FALLER, K. H. N81-12486
FANETTI, E. N81-12630
FARBER, G. N81-12203

FARBER, P. S. N81-12620
FARMER, M. G. N81-12116
FAVIER, D. N81-12030
FEARN, D. G. N81-12153
FEESER, L. J. N81-12447
FELLER, A. N81-12328
N81-12746
FENLON, F. H. N81-12823
FERBER, R. R. N81-12989
FETZNER, W. N. N81-12725
FIALA, C. N81-12461
FIARMAN, M. S. N81-12860
FICHTEL, C. N81-12959
FICK, S. E. N81-12440
FIELDS, J. L. N81-12106
FIFER, R. A. N81-12258
FILEVICH, A. N81-12844
FINCH, C. R. N81-12921
FISCHER, M. J. N81-12750
N81-12780
FISCHER, P. N81-12236
FISHMAN, G. S. N81-12808
FITTON, B. N81-12992
FLEMING, W. H. N81-12778
FLORES, C. N81-12630
FLOWERS, M. C. N81-12228
FLOYD, R. W. N81-12334
FONTANELLA, J. C. N81-12878
FONTANET, P. N81-12032
FORGSBERG, K. N81-12154
FOULON, B. N81-12292
FOWLER, R. N81-12511
FOWLIS, W. W. N81-12676
FRANKEN, W. M. P. N81-12902
FRANKOVICH, J. M. N81-12789
FREDERICK, J. E. N81-12679
FREELAND, R. E. N81-12155
FREEMAN, D. N81-12481
FREESE, J. M. N81-12402
FREY, H. N81-12680
FREY, R. B. N81-12257
FRIANT, C. L. N81-12440
FRIBERG, J. N81-12815
FRIPP, A. L. N81-12389
FRISK, B. N81-12633
FRITTS, M. N81-12850
FRITZLER, E. A. N81-12604
FROGGATT, M. N81-12251
FROUIN, R. N81-12501
FULLER, E. R., JR. N81-12232
FUNG, A. K. N81-12310
FUSARO, R. L. N81-12226
FUTTERER, A. T. N81-12460

G

GADRE, J. G. N81-12139
GAFFNEY, P. W. N81-12891
GAINES, L. H. N81-12589
GALLAGHER, H. N81-12339
GALLOWAY, J. N. N81-12663
GALWAY, R. D. N81-12394
GAMMA, F. N81-13014
GARBUNY, M. N81-12405
GARDNER, J. N81-12850
GARING, K. L. N81-12604
GARRETT, H. B. N81-12147
GARVEY, D. B. N81-12656
GARVEY, T. D. N81-12530
GARY, A. V. N81-12749
GARY, J. H. N81-12273
GASSAWAY, J. D. N81-12327
N81-12329
GASTEBOIS, P. N81-12996
GATES, R. V. N81-12057
GAY, B. N81-12355
GEISLER, J. E. N81-12676
GEISSLER, W. N81-12035
GERBER, G. B. N81-12732
GHAFFARI, H. T. N81-12595
GHEZZI, U. N81-13014
GIELOW, T. A. N81-12302
GILBERT, E. S. N81-12733
GILLESPIE, L. K. N81-12288
N81-12289
GILLETTE, D. N81-12399
GILMOUR, J. L. N81-12944
GIORDANO, S. N81-12316
GIRARD, A. N81-12159
GIRAUDBIT, J. N. N81-12184
GISMONDI, T. N81-12158
GLASGOW, T. K. N81-12982
GODBEE, H. W. N81-12858
GODEL, H. N81-12117
GOEBEL, J. E. N81-12508
GOERING, S. W. N81-12604
GOES, C. J. N81-12706
GOETTLE, R. J., IV N81-12612
N81-12613
GOILLOT, C. N81-12522
GOLBITZ, W. C. N81-12365
GOLD, S. N81-12850
GOLDBERG, I. B. N81-12272
GOLDMAN, A. N81-12107
GOLDRING, G. N81-12844
GOLDSMITH, M. N81-12523
GOLDSTEIN, M. L. N81-12966
GOLDSTEIN, S. A. N81-12848
N81-12857
GOMER, R. N81-12904
N81-12915
GONG, L. N81-12361
GONZALEZ, P. N81-12514
GOO, E. K. W. N81-12917
GOODENOUGH, S. J. N81-12771
GOODMAN, D. N81-12237
GOODRICH, G. C. N81-12968
GOPAL, I. S. N81-12139
GORGE, Y. N81-12751
GORMAN, P. N81-12620
GOSSMANN, H. N81-12482
GOUDEAU, J. C. N81-12281
GOULD, J. M. N81-12747
GOULDIN, F. C. N81-12997
GOULIANOS, K. N81-12837
GOVER, A. N81-12416
GRAEBER, R. C. N81-12727
GRAFER, M. N81-12776
GRAFF, C. N81-12932
GRAHAM, R. W. N81-12363
GRAN, M. H. N81-12162
GRAND, P. N81-12861
GRANTHAM, W. D. N81-12043
GRAY, I. N81-12472
GRAY, J. N81-12062
GREBOWSKY, J. M. N81-12682
GREEN, H. J. N81-12573
GREEN, R. E., JR. N81-12440
GREGOIRE, G. N81-12159
GRIFFIN, O. M. N81-12556
GRIFFITH, N. D. N81-12780
GRONCKI, P. J. N81-12612
N81-12613
GROSS, W. N81-12678
GROSSI, M. D. N81-12301
GROSSMAN, R. L. N81-12710
GROUTAGE, F. D. N81-12144
GUALTIERI, J. G. N81-12905
GUARINI, G. N81-12630
GUDERLEY, K. G. N81-12025
GUENTHER, R. N81-13002
GUILD, W. R. N81-12721
GUPTA, A. K. N81-12301
GURSON, A. L. N81-12427
GUSINOW, M. A. N81-13013
GUSTAFSSON, A. L. N81-12633
GUZZARDI, R. N81-12731

H

HAAS, W. H. N81-12146
HABEL, C. N81-12781
HABERAECKER, P. N81-12482
HABERCOM, G. E., JR. N81-12114
N81-12293
N81-12294
N81-12295
N81-12667
N81-12715
N81-12716
N81-12755
N81-12756
N81-12783
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N81-12880
HACK, J. E. N81-12452
HACKETT, R. M. N81-12194
HAGER, J. B. N81-12054
HAHNE, G. N81-12188
HALBACH, K. N81-12818
HALE, L. G. N81-12908
HALFORD, G. R. N81-12982
HALL, M. G. N81-12057
HALL, R. C. N81-13010
HALLDORSSON, T. N81-12420
HAMILTON, B. N81-12158
HAMMOND, C. E. N81-12074
HAMMONS, A. S. N81-12660
HANNAN, B. F. N81-12048
HANSEN, S. N81-12339
HARDEGEN, H. N81-12063
HARDIN, J. C. N81-12719
HARDING, A. K. N81-12962
HARKNEY, R. D. N81-12095
HARLOFF, H. J. N81-12347
HARRIS, C. E. N81-12697
N81-12698
HARRIS, T. N81-12077
HARRISON, E. A. N81-12735
HARRISON, F. N81-12353
HARSHA, P. T. N81-12192
HART, J. N81-12123
HART, W. G. J. N81-12187
HART, W. G. J. T. N81-12081
HARTLEY, D. L. N81-13013
HARTMAN, J. S. N81-12609
HARVEY, J. K. N81-12378
HARVEY, R. N81-12339
HAYES, M. H. N81-12790
HAZELTINE, R. D. N81-12894
HEARD, W. L., JR. N81-12445
HEASTON, R. J. N81-12926
HEATH, W. G. N81-12076
HECKMAN, R. V. N81-12178
HEILMAN, J. L. N81-12511
HEIMKE, G. N81-12629
HELBERT, J. N. N81-12336
HELIARD, J. C. N81-12768
HELVEY, R. A. N81-12650
HENDREY, G. R. N81-12661
N81-12663
HENDRIX, T. L. N81-12430
HENNINGSEN, T. N81-12405
HENTSCHEL, W. N81-12063
HEYMAN, J. S. N81-12724
HILFINGER, P. N. N81-12768
HILLAN, W. J. N81-12191
HILLER, H. N81-12693
HINES, R. A. N81-12205
N81-12344
HINGST, U. N81-12381
HINNERICHS, T. S. N81-12450
HIPPENSTEELE, S. A. N81-12089
HIRSCHBEIN, M. S. N81-12446
HISHAW, R. J. N81-12241
HIXSON, M. M. N81-12496
N81-12504
HO, J. K. N81-12594
HOCKEY, B. J. N81-12231
HODGE, S. A. N81-12819
HODGES, D. H. N81-12071
HODGES, T. N81-12478
N81-12489
HOEKZEMA, J. A. N81-12902
HOFFMAN, H. C. N81-12156
HOFFMAN, S. J. N81-12262
HOFFMANN, H. E. N81-12690
N81-12691
HOGG, J. C. N81-12170
HOLEHOUSE, I. N81-12069
HOLLEBEEK, R. J. N81-12840
HOLLEMAN, J. W. N81-12660
HOLLY, R. H. N81-12302
HOLMAN, G. D. N81-12975
HOLMES, B. J. N81-12012
HOLMGREN, J. L. N81-12441
HOLT, H. E. N81-12955
HOLT, S. S. N81-12958
HOLTHUIS, J. T. N81-12342
HONLINGER, H. N81-12117
HOPPIN, G. S., III N81-12088
HORN, R. T. N81-12418
HORNG, H. E. N81-12923
HORTON, C. L. N81-12488
HOSENFELD, H. G. N81-12998
HOUGHTON, W. W. N81-12070
HOUSER, T. N81-12197
HOWGATE, D. W. N81-12865

HSIEH, S. J. N81-12913
HUB, K. A. N81-12621
HUBER, C. C. N81-12621
HUBER, W. A. N81-12315
HUBERMAN, M. N. N81-12162
HUDDLESTON, R. L. N81-12457
HUDSON, E. A. N81-12612
N81-12613
HUDSON, J. B. N81-12193
HUDSPETH, R. T. N81-12599
HUELLEC N81-12221
HUET, M. N81-12535
HUGHES, P. N81-12368
HUISMANN, H. N81-12781
HUIZENGA, J. R. N81-12841
HULL, G. G. N81-12646
HULL, J. R. N81-12606
HUMPHREY, M. P. N81-12550
HUNDEMANN, A. S. N81-12541
N81-12636
N81-12637
N81-12638
N81-12639
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N81-12694
N81-12718
N81-12970
HUNGER, H. F. N81-12568
HUNKINS, K. N81-12687
HUNN, B. D. N81-12624
HUNT, L. P. N81-12551
HURST, L. G. N81-12088
HUSKISSON, D. H. N81-12276
HUSTER, G. N81-12995
HUSTON, R. L. N81-12741
HUTCHINGS, T. J. N81-12395
HWANG, C. N81-12116

I

ICE, J. N. N81-12189
ICHBIAH, J. D. N81-12768
IHLEFELDT, G. N81-12348
ILES, P. A. N81-12553
ILIFF, K. W. N81-12744
IONSON, J. A. N81-12882
N81-12975
ISAACSON, D. L. N81-12490
N81-12491
ITIER, B. N81-12522
IVERSON, C. H. N81-12195

J

JACKSON, F. C. N81-12296
JACKSON, R. D. N81-12497
N81-12498
JACOBS, H. N81-12337
JAEMARK, B. N81-12769
JANZEN, G. N81-12899
JARBOE, D. M. N81-12432
JAVAN, A. N81-12829
JAY, R. L. N81-12108
JEKELI, C. N81-12669
JELALIAN, A. V. N81-12697
N81-12698
JENKINS, J. M. N81-12084
JENKINS, R. F. E. N81-12753
JENKINS, R. V. N81-12356
JENNINGS, T. N81-12527
JENSEN, D. E. N81-12167
JENSEN, K. J. N81-12615
JESSEN, J. M. N81-12968
JOHN, H. H. N81-12492
JOHNSON, D. H. N81-12573
JOHNSON, D. W. N81-12189
JOHNSON, E. H. N81-12116
JOHNSON, I. N81-12204
N81-12280
JOHNSON, N. J. E. N81-12385
JOHNSON, N. M. N81-12910
JOHNSON, R. N81-12237
JOHNSON, T. R. N81-12898
JOHNSTON, D. C. N81-12924
JONES, C. N81-12514
JONES, J. E. N81-12757
N81-12758
N81-12773
N81-12774
JONES, M. N81-12351
JONES, R. F. N81-12595
JONES, T. V. N81-13000
JUILLERAT, R. N81-12159
JULLEN, J. C. N81-12359
JUNG, C. N81-12414
JUNKIN, B. G. N81-12512

K

KAEHLER, H. N81-12427
KAINZ, F. B. N81-12203
KALLENBERG, O. N81-12185
KAMIN, M. N81-12745
KAMINURA, T. N81-12885
KAMMAN, J. W. N81-12741
KANNEMANS, H. N81-12375
KANTOR, A. S. N81-12130
KAO, T. W. N81-12717
KAPP, J. A. N81-12458
KAPPLER, G. N81-12995
KARPEN, J. T. N81-12973
KAUFFMAN, C. W. N81-12105
KAVESHNIKOV, V. M. N81-12951
KAYS, W. M. N81-12376
KAYSER, L. D. N81-12023
KEHS, R. A. N81-12335
KELLER, A. N81-12931
KELLEY, D. F. N81-12228
KELLY, H. N. N81-12362
KELSALL, G. H. N81-12349
KENDIG, J. N81-12158
KENTON, E. N81-12736
KERRISK, J. F. N81-12624
KEY, P. F. N81-12692
KHEMTHONG, S. N81-12553
N81-12610
KHORAMMI, J. N81-12813
KHOT, N. S. N81-12077
KIBBEY, A. H. N81-12858
KIEDROWSKI, J. N81-12158
KIEFER, R. W. N81-12494
N81-12518
KIMBALL, G., JR. N81-12109
KIMBALL, K. A. N81-12730
KING-HELE, D. G. N81-12132
N81-12693
KING, J. D. N81-12524
KINOSHITA, K. N81-12175
KIRCHGAESSNER, B. N81-12626
KISMAN, K. E. N81-12729
KISTNER, W. N81-12931
KLARICH, C. R. N81-12457
KLASS, D. L. N81-12570
KLEEMAN, P. N81-12612
N81-12613
KLEIN, L. W. N81-12965
N81-12968
KLEINBAUER, R. N81-12420
KLIPPEL, H. T. N81-12902
KOCH, H. N81-12380
KOCKARTS, G. N81-12673
KODANDAPANI, K. L. N81-12300
KOEPF, G. A. N81-12407
KOEPKE, B. G. N81-12234
KOGAN, A. N81-12573
KOIDE, G. T. N81-12587
KONING, J. N81-12249
KORWAR, R. M. N81-12806
KOUTS, H. J. C. N81-12861
KRACK, K. N81-12907
KRAFT, C. L. N81-12726
KRAUSE, W. N81-12420
KREEB, H. N81-12381
KREISL, F. N81-12348
KRESOVICH, S. N81-12534
KRIEG-BRUECKNER, B. N81-12768
KRIEGSMANN, G. A. N81-12309
KRIER, H. N81-12262
KRISHNASWAMY, S. V. N81-12597
KRUGER, R. N81-12976
KUENY, J. L. N81-12373
KUHN, M. N81-12117
KULAK, R. F. N81-12461
KULPA, S. M. N81-12867
KUMAR, S. N81-12779
KUNG, R. M. N81-12071
KURTZ, D. W. N81-12943
KUSHNER, H. J. N81-12805
KUZANEK, J. F. N81-12145

L

LABBE, J. N81-13005
LABOVITZ, M. L. N81-12526
LADD, M. N81-13011
LAFRATE, G. J. N81-12336
LAGASSE, R. R. N81-12242
LALAK, J. N81-12396
LAMERIS, J. N81-12252
LANCASTER, E. R. N81-12527
LANDIS, K. E. N81-12547
N81-12548
LANGEL, R. N81-12527
LANGERHOLC N81-12420
LARKIN, R. G. N81-12060
LARSSON, N. N81-12223
LARSSON, S. E. N81-12465
LASCHE, G. P. N81-12335
LAUVER, R. W. N81-12982
LAVIN, M. L. N81-12523
LAVOIE, G. A. N81-12198
N81-12199
LAWSON, A. G. N81-12422
LE, T. Q. N81-12662
LEADBETTER, M. R. N81-12809
LEBALLEUR, J. C. N81-12372
LEBOT, Y. N81-13005
LEDGARD, H. F. N81-12768
LEE, J. N81-12705
LEE, P. S. N81-12812
LEE, R. N81-12857
LEE, S. H. D. N81-12280
LEE, T. N81-12687
LEES, L. N81-12647
LEHTINEN, B. N81-12093
LEININGER, G. G. N81-12101
N81-12104
LEMAIRE, J. N81-12971
LEMKE, U. N81-12348
LENSKI, J. W., JR. N81-12075
LEONARD, R. G. N81-12100
LEPPING, R. P. N81-12963
N81-12965
N81-12968
LEVENE, A. A. N81-12770
LEVERANT, G. R. N81-12452
LEVINE, R. D. N81-12833
LEWELLWN, W. S. N81-12701
LEWIS, A. J. N81-12490
LEWIS, E. B. N81-12660
LIAW, M. N81-12602
LIBBRA, F. N81-12403
LIDDLE, S. G. N81-12949
LIEBERT, R. N81-12396
LIEBST, B. S. N81-12634
LIGRANI, P. M. N81-12376
LILLESAND, T. M. N81-12506
N81-12507
N81-12518
LIMAGE, C. R. N81-12106
LINCOLN, J. W. N81-12463
LIND, M. A. N81-12609
LINDVALL, T. N81-12810
LING, K. S. N81-12553
N81-12610
LININGSTON, W. W. N81-12019
LINK, H. A. N81-12213
LINSON, L. M. N81-12883
LIPINSKY, E. S. N81-12534
LIPPENS, C. N81-12674
LITTLE, L. J. N81-12061
LOMBARDI, T. N81-12746
LOURENCO, L. N81-12383
LOWE, C. H. N81-12532
LUDFORD, G. S. S. N81-12190
LUERS, J. K. N81-12677
LUETJERING, G. N81-12222
LUKACHINSKI, J. N81-12612
N81-12613
LUKAZEK, T. N81-12332
LULA, J. W. N81-12341
LUND, D. J. N81-12739
LUNDGREN, S. N81-12633
LUNDSTROM, M. S. N81-12607
LYNCH, N. A. N81-12780
LYON, R. J. P. N81-12495

M

MA, H. H. N81-12791
MAARSINGH, R. A. N81-12033
MACCONOCHIE, I. O. N81-12388
MACDONALD, A. G. N81-12083
MACK, B. A. N81-12060
MACKE, H. H. N81-12188
MACKNIGHT, W. J. N81-12229
MADALA, R. V. N81-12699
MADER, L. N81-12291
MAGGIONI, G. N81-12403
MAGRE, P. N81-13005
MAGUIRE, J. N81-12058
MAHMOOD, Q. N81-12329
MAHONEY, A. R. N81-12401
MAHR, H. N81-12393
MAINE, R. E. N81-12744
MAINGUY, A. M. N81-12159
MAKINO, M. N81-12885
MALIK, R. J. N81-12333
MALONE, D. L. N81-12485
MALVEZZI, A. M. N81-12901
MANLEY, T. O. N81-12687
MARCHAL, P. N81-12159
MARCHAND, M. N81-12080
MARESCA, C. N81-12030
MARSHALL, F. E. N81-12961
MARTENEY, P. J. N81-12255
MARTINEC, E. J., JR. N81-12370
MARTINI, P. R. N81-12500
MARTINSEN, W. E. N81-12189
MARTONE, J. A. N81-12651
MASK, R. L. N81-12024
MASKELL, E. C. N81-12037
MASLEN, K. R. N81-12734
N81-12827
MASSATT, P. N81-12814
MASUREL, G. N81-12729
MATSMO, K. N81-12139
MATUSKA, W. N81-12960
MAURO, F. M. N81-12067
MAXFIELD, D. P. N81-12267
MCAFEE, W. S. N81-12336
MCCARVILLE, M. N81-12197
MCCAULEY, J. W. N81-12870
MCCLELLAN, J. H. N81-12790
MCDERMID, J. A. N81-12772
N81-12775
MCDONALD, F. B. N81-12967
MCELMAN, J. A. N81-12427
MCGHEE, R. J. N81-12015
MCHENRY, K. D. N81-12234
MCILROY, H. M. N81-12244
MCINTOSH, S. C., JR. N81-12451
MCISAAC, J. P. N81-12685
MCKAY, M. F. N81-12487
MCLEOD, A. H. N81-12577
MCMAHON, J. N81-12850
MCNAMARA, T. M. N81-12267
MEADOWS, H. E. N81-12139
MEI, K. K. N81-12308
MEINERT, D. L. N81-12485
MEISNER, D. E. N81-12507
MEISSNER, D. N81-12420
MEJZAK, R. S. N81-12748
MELLIAR-SMITH, P. M. N81-12777
MENDENHALL, M. R. N81-12014
MENEGHINI, R. N81-12297
MERAZZI, S. N81-12801
MERRILL, R. M. N81-12276
MERRILL, W. C. N81-12091
MERZ, W. E. N81-12213
MEYER, D. L. N81-12969
MICHEL, H. N81-12915
MICHEL, R. N81-12359
MICLET, L. N81-12782
MILES, J. H. N81-12821
MILLER, D. R. N81-12227
MILLER, R. L. N81-12654
MILLS, G. R. N81-12116
MINOTT, P. O. N81-12386
N81-12387
MIRIN, A. A. N81-12927
MITCHELL, B. C. N81-12338
MITLEHNER, H. N81-12925
MJOLSNESS, R. C. N81-12369
MOFFAT, R. J. N81-12376
MOHRI, A. N81-12884
MOLER, W. F. N81-12686
MONGET, J. M. N81-12501
MONICI, M. N81-12462
MONTE, R. N81-12576
MONTGOMERY, D. N81-12896
MONTGOMERY, R. C. N81-12812
MONTIGNY, F. N81-12159
MOORE, C. J. N81-12825
MOORE, E. E. N81-12749
MOORE, J. E. N81-12624
MOORE, L. R., III N81-12808
MOORE, R. L. N81-12792
MORALES, G. J. N81-12888
MORAN, J. N81-12391
MORAWETZ, C. S. N81-12309
MOREAU, P. N81-13005
MOREL, R. N81-12165
MORENUS, P. K. N81-12276
MORENUS, T. M. N81-12276
MORRISON, P. J. N81-12797
N81-12882
N81-12975
MORRISSEY, M. N81-12527
MORT, J. N81-12992
MORTARA, W. N81-12435
MOSER, F. N81-12900
MOSHER, D. N81-12848
MOSKOWITZ, P. D. N81-12662
MOSTEK, A. N81-12678
MROCZYNSKI, R. P. N81-12481
MUELLER, A. W. N81-12822
MUELLER, G. E. N81-12181
MUELLER, I. I. N81-12525
MUELLER, W. N81-12381
MUKHOPADHYAY, A. K. N81-12146
MULLER, W. W. N81-12531
MULLERY, G. P. N81-12770
MULLIKIN, T. W. N81-12795
MURPHY, C. H. N81-12142
MURPHY, D. J. N81-12248
MUSHOTZKY, R. F. N81-12958
MUSQUIZ, D. N81-12650
MYERS, V. I. N81-12511
MYLES, K. M. N81-12204
N81-12280
MYLIN, D. C. N81-12027
MYRA, J. R. N81-12890
N81-12893

N

NABER, F. H. N81-12444
NAGL, W. N81-12420
NAMAN, T. M. N81-12270
NAPADENSKY, H. S. N81-12260
NASH, J. F. N81-12135
N81-12136
N81-12137
N81-12138
NATESAN, K. N81-12216
NAUS, D. J. N81-12459
NAZIMEK, K. N81-12589
NEHME, A. N81-12782
NEIUWENDIJK, P. A. T. N81-12706
NELSON, E. V. N81-12577
NEUTS, M. F. N81-12779
NEWMAN, A. L. N81-12887
NGUYEN, V. T. N81-12658
NIBBELINK, K. H. J. N81-12902
NIBLETT, L. T. N81-12470
NICOLIS, C. N81-12670
N81-12696
NICOLIS, G. N81-12670
NIELSEN, K. K. N81-12163
NIETUBICZ, C. J. N81-12023
NISHI, R. Y. N81-12729
NISSEN, K. N81-12236
NIU, K. N81-12886
NOLA, F. J. N81-12330
NOLL, T. E. N81-12116
NOMOTO, K. N81-12957
NORTON, S. A. N81-12663
NORWOOD, D. A. N81-12345

O

OBA, K. N81-12845
OBRIEN, S. N81-12479
OBRIEN, T. J. N81-12591
ODORICO, J. N81-12466
OEBERG, S. N81-12465
OGALLAHER, J. J. N81-12874
OGAWA, A. N81-12454
N81-12455
OLAH, S. N81-12553
N81-12610
OLAND, C. B. N81-12459
OLDFIELD, J. V. N81-12765
OLDFIELD, M. L. G. N81-13000
OLIVARI, D. N81-13015
OLIVER, D. A. N81-12701
OLSON, D. A. N81-12573
OMAR, M. H. N81-12707
OMARA, P. A. N81-12739
OPILA, R. N81-12904
N81-12915
ORAN, E. S. N81-12887
ORENS, J. N81-12850
OSCAR, K. J. N81-12720
OSKAM, B. N81-12036
OTT, R. H. N81-12306
OTVOS, J. W. N81-12842
OWEN, J. M. N81-13007
OWENS, F. J. N81-12263

P

PADLOG, J. N81-12458
PAGE, D. E. N81-12992
PAINTER, L. R. N81-12200
PALMER, R. B. N81-12213
N81-12876
PANIZZA, E. N81-12435
PANKOVE, J. I. N81-12909
PAPE, R. N81-12260
PAPELL, S. S. N81-12363
PAPPERT, R. A. N81-12686
PARDOUX, E. N81-12778
PARK, H. D. N81-12916
PARKER, D. L. N81-12942
PARKS, S. M. N81-12591
PARMIGIANI, F. N81-12677
PASE, C. P. N81-12532
PASTIRIK, E. N81-12549
PASTRE, C. N81-12159
PATRINOS, A. A. N. N81-12654
PATTERSON, J. L. N81-12719
PAULIKAS, G. A. N81-12683
PAULKOVICH, J. N81-12331
PAUWELUSSEN, J. P. N81-12811
PAYNE, D. A. N81-12916
PEALAT, M. N81-13009
PEARCE, R. G. N81-12692
PECKHAM, J. B. N81-12737
PECZKOWSKI, J. L. N81-12102
PEDERSEN, A. N81-12992
PEDERSON, L. R. N81-12609
PELETIER, L. A. N81-12811
PERDU, M. N81-12380
PERKINS, J. S. N81-12177
PERRIER, A. N81-12522
PERRY, C. R., JR. N81-12516
N81-12517
PETERMAN, D. J. N81-12918
PETERSEN, R. N81-12259
PETERSEN, R. C. N81-12552
PETIT, G. N81-12182
PETIT, V. N81-12521
PETRICK, M. N81-12898
PETTIT, R. B. N81-12401
N81-12623
PEYRONY, M. N81-12183
PFLUG, G. N81-12348
PFUNDSTEIN, R. T. N81-12658
PHILLIPS, J. D. N81-12065
PHILLIPS, L. N. N81-12248
PHILLIPS, W. D. N81-12408
PICKUS, M. R. N81-12342
PIEPER, R. N81-12162
PILLASCH, D. W. N81-12787
PINCOMBE, J. R. N81-13007
PINSKER, W. J. G. N81-12113
PINTO, B. P. N81-12060
PIPER, W. A. N81-12219
PITTMAN, J. L. N81-12021
PITTS, M. N81-12675
PLEASANTS, W. A., III N81-12072
POECKENTRUP, J. N81-12380

POHLIG, S. C. N81-12789
POOLE, B. D., JR. N81-12388
POT, P. J. N81-12034
POWELL, J. N81-12861
PRADHAN, D. K. N81-12300
PRASK, H. J. N81-12443
PRELAT, A. E. N81-12495
PRESTON, E. L. N81-12660
PRIDDY, W. J. N81-13001
PROSSER, R. A. N81-12425
PRUZANSKY, J. N81-12203

Q

QUATIERI, T. F. N81-12790
QUERZOLA, B. N81-12419
QUINN, R. D. N81-12361

R

RABINOVITCH, B. S. N81-12228
RAEUCHLE, E. N81-12900
RAJUT, B. S. N81-12807
RALSTON, R. W. N81-12311
RAMANATHAN, V. N81-12620
RAPP, R. H. N81-12669
RAUT, M. K. N81-12206
N81-12217
N81-12344
REBONT, J. N81-12030
REDFIELD, D. N81-12601
REDFIELD, E. N81-12929
REED, W. E. N81-12321
N81-12322
N81-12354
N81-12436
N81-12437
REHAK, P. N81-12845
REHBEIN, D. K. N81-12218
REHDER, J. J. N81-12445
REICH, P. N81-12521
REIGEL, S. N81-12620
REITER, E. R. N81-12657
N81-12689
N81-12702
RENNE, D. S. N81-12704
REUKAUF, P. J. N81-12067
RICHARD, D. C. N81-12631
RICHARD, J. M. N81-12836
RICHARD, J. P. N81-12907
RICHARDS, B. E. N81-12999
RICKETTS, R. H. N81-12448
RIEBE, G. D. N81-12021
RIECKE, W. D. N81-12931
RIEDEL, S. A. N81-12110
RIETHMULLER, M. L. N81-12377
N81-12383
N81-13004
RIFKIN, S. B. N81-12658
RINDER, R. N81-12260
RINOLFI, R. N81-12435
RITCHIE, J. P. N81-12264
RITTENBACH, O. E. N81-12314
RITTER, L. C. N81-12176
RIZZI, L. N81-12403
ROBBINS, W. H. N81-12981
ROBERT, M. N81-12165
ROBERT, P. N81-12509
ROBINSON, G. C. N81-12459
ROEHL, P. N81-12236
ROHANI, B. N81-12424
ROHDE, R. S. N81-12412
ROLLINGER, C. R. N81-12781
ROLLWITZ, W. L. N81-12524
ROOKE, D. P. N81-12469
ROOTZEN, H. N81-12809
ROPARS, S. N81-12996
ROSE, P. N81-12798
ROSENBLUTH, M. N. N81-12846
ROSENTHAL, J. N81-12650
ROSS, R. L. N81-12333
ROSS, W. D. N81-12191
ROSSI, P. N81-12403
ROTE, D. M. N81-12705
ROTH, M. N81-12671
ROTHBERG, P. F. N81-12566
ROUBINE, O. N81-12768
RUBIN, A. G. N81-12147
RUBINCAM, D. P. N81-12528
RUBINSHTEYN, Y. S. N81-12695
RUSSELL, R. A. N81-12155
RUST, R. H. N81-12509

S

SAH, R. C. N81-12834
SAIN, M. K. N81-12103
SAMPSON, W. J. N81-12553
N81-12610
SANDEL, F. L. N81-12848
SANDERS, M. G. N81-12730
SANDRI, G. N81-12701
SANDUSKY, W. F. N81-12704
SANSONE, M. J. N81-12278
SAPIENZA, R. N81-12278
SAPOWITH, A. D. N81-12427
SARI, S. O. N81-12873
SARIPALLI, K. R. N81-12360
SARKAR, T. K. N81-12307
SATO, T. N81-12885
SATRIANA, D. N81-12260
SAU, R. N81-12193
SAVAGE, R. O. N81-12333
N81-12905
SAYRE, J. A. N81-12242
SCARPACE, F. L. N81-12485
SCHAFER, R. M. N81-12103
SCHARDT, A. W. N81-12967
SCHIAVELLO, B. N81-12433
SCHMER, F. A. N81-12511
SCHMIDT, A. N81-12781
SCHMIDT, E. N81-12798
SCHMIDT, F. A. N81-12218
SCHMITZ, F. H. N81-12824
SCHNEIDER, C. P. N81-12188
SCHNEIDER, E. N81-12900
SCHNEIDER, H. J. N81-12781
SCHNEIDER, R. J. N81-12727
SCHNOELLER, M. N81-12925
SCHNURR, N. M. N81-12624
SCHODL, R. N81-13003
SCHOFIELD, C. L. N81-12663
SCHOLZ, D. K. N81-12504
SCHRADE, J. N81-12380
SCHROEPFER, T. W. N81-12550
SCHRUMPF, B. J. N81-12490
SCHUELLER, P. G. N81-12900
SCHULTZ, D. L. N81-13000
SCHULTZ, P. F. N81-12854
SCHUTZ, D. N81-12464
SCHUURMAN, W. N81-12902
SCHWARTZ, A. N81-12905
SCHWARTZ, H. J. N81-12985
N81-12986
SCHWARTZ, M. N81-12139
SCHWARTZ, R. J. N81-12607
SCHWARTZ, R. L. N81-12777
SCHWEPPE, H. N81-12781
SCOTT, H. A., JR. N81-12652
SCOTT, J. S. N81-12975
SCOTT, T. E. N81-12429
SEAMON, R. E. N81-12793
N81-12847
SEEFELDNER, W. N81-12348
SEGRE, C. U. N81-12924
SEGUIN, B. N81-12521
SEINER, J. M. N81-12719
SELDNER, K. N81-12092
SELLEN, J. M. N81-12162
SEMIKOV, Y. I. N81-12951
SEN, M. N81-12433
SENSBURG, O. N81-12117
SERLEMITSOS, P. J. N81-12958
SESSIONS, G. R. N81-12727
SESTAK, M. L. N81-12489
SETHI, D. S. N81-12203
SEVENHUIJSEN, P. J. N81-12476
SEVIAN, W. A. N81-12662
SEYBOTH, J. N81-12995
SHAFFER, P. W. N81-12663
SHAPIRO, H. N81-12976
SHARE, S. N81-12868
SHEARER, J. A. N81-12280
SHELDON, R. G. N81-12066
SHELTON, R. N. N81-12923
N81-12924
SHEMETA, E. H. N81-12149
SHEN, Y. R. N81-12875
SHERMAN, A. N81-12157
SHIMOKAWA, T. N81-12449
SHIRLEY, D. A. N81-12871
SHIRLEY, J. A. N81-13010
SHIVAPRASAD, B. G. N81-12366
SHOOMAN, M. L. N81-12763
SHORT, R. W. N81-12897
SHRINER, C. R. N81-12660
SHU, P. N81-12297
SHUFORD, R. J. N81-12070
SHURE, L. I. N81-12988
SICZEK, A. A. N81-12204
N81-12280
SIH, G. C. N81-12454
N81-12455
SILLMAN, S. N81-12574
N81-12576
SIMON, P. C. N81-12972
SIMPSON, R. L. N81-12360
N81-12366
SING, H. C. N81-12727
SIZER, T. R. H. N81-12932
SKILTON, P. J. N81-12319
SKIRA, C. A. N81-12096
SLAGG, N. N81-12264
SLINEY, H. E. N81-12984
SLOBODNIK, B. A. N81-12740
SLONE, H. O. N81-12979
SLOTTA, L. S. N81-12599
SMALLWOOD, D. O. N81-12367
SMIDT, F. A. N81-12903
SMITH, B. W. N81-12958
SMITH, G. S. N81-12492
SMITH, H. G. N81-12491
SMITH, J. E. N81-12662
SMITH, P. M. N81-12043
SMITH, R. T. N81-12442
SMITH, S. D. N81-12845
SMITH, W. N81-12343
SMYK, E. B. N81-12280
SO, R. M. C. N81-13011
SOEDER, J. F. N81-12093
SOICHER, H. N81-12313
SOKOLOWSKI, S. J., II N81-12058
SORAN, P. D. N81-12793
N81-12847
SORVARI, J. M. N81-12143
SOWELL, R. R. N81-12623
SPEARS, R. K. N81-12238
N81-12239
SPEITKAMP, L. N81-12380
SPRANGLE, P. N81-12409
N81-12416
ST.CLAIR, A. K. N81-12174
ST.CLAIR, T. L. N81-12174
STAMPER, D. A. N81-12739
STAMPER, J. A. N81-12889
STANISLAS, M. N81-12031
STATEN, H. S. N81-12856
STECKER, F. W. N81-12828
STEFANINI, A. N81-12462
STEGER, J. L. N81-12018
STEHLE, C. G. N81-12684
STEHLIN, P. N81-12801
STEINBERG, M. N81-12237
N81-12277
N81-12861
STEPHANAKIS, S. J. N81-12848
STEPHENS, M. M. N81-12398
STEPHENS, W. B. N81-12071
STERN, D. P. N81-12493
N81-12681
STERN, T. E. N81-12139
STEVENS, R. N81-12349
STEVENSON, K. L. N81-12581
STEWART, D. S. N81-12190
STEWART, J. N81-12487
STEWART, W. L. N81-12980
STICKER, H. N81-12837
STIEGER, W. N81-12278
STONE, D. A. N81-12261
STORY, A. S. N81-12488
STRAND, R. C. N81-12876
STRANGE, J. D. N81-12135
N81-12136
N81-12137
N81-12138
STREETS, D. G. N81-12656
STREETS, W. E. N81-12615

STRUTH, A. N81-12662
STUDER, P. A. N81-12331
STUREK, W. B. N81-12027
STURGEON, W. R. N81-12065
STURM, G. P., JR. N81-12268
SUBRAMANIAN, S. V. N81-12140
SULLIVAN, R. D. N81-12701
SUN, C. T. N81-12172
SUTHERLAND, J. C. N81-12722
SUTHERLAND, L. C. N81-12644
N81-12645
SUTTER, J. R. N81-12405
SWANSON, G. D. N81-12245
SWIFT, W. M. N81-12280
SYDOR, M. N81-12510
SYSKA, A. J. N81-12384

T

TAFF, L. G. N81-12143
TAGG, R. N81-12357
TAHILIANI, V. N81-12368
TAKAHASHI, H. N81-12861
TANAKA, S. N81-12449
TANG, C. M. N81-12409
TANG, M. H. N81-12066
TANIHATA, I. N81-12859
TANNER, M. N81-12151
TANNHAEUSER, R. N81-12348
TAPHUOC, L. N81-12374
TAPIA, M. A. N81-12786
TARAN, J. P. N81-13009
TARDIVEL, F. N81-12352
TATOM, F. B. N81-12134
TAUTZ, M. F. N81-12141
TAYLOR, A. M. K. P. N81-13006
TAYLOR, B. G. N81-12992
TAYLOR, H. E. N81-12932
TAYLOR, H. S. N81-12414
TAYLOR, N. L. N81-12761
TEATS, F. G. N81-12280
TEMME, N. M. N81-12800
TERRELL, G. R. N81-12483
N81-12515
THART, W. G. J. N81-12179
N81-12186
THIEMAN, J. R. N81-12966
THOM, R. D. N81-12458
THOMAS, L. D. N81-12835
THOMAS, M. T. N81-12609
THOMAS, R. L. N81-12981
THOMPSON, J. F. N81-12017
THOMSON, J. S. N81-12268
THOMSON, R. M. N81-12232
THOUY, G. N81-12521
TILTON, J. C. N81-12520
TIRA, J. S. N81-12240
TISUE, M. N81-12620
TIURI, M. N81-12126
TIWARI, S. N. N81-12140
TOBIN, M. J. N81-12068
TOLMAN, C. H. N81-12745
TOM, V. T. N81-12790
TOOMRE, J. N81-12123
TOROK, E. J. N81-12745
TORRADAS, J. M. N81-12230
TOWILL, L. E. N81-12660
TRAINOR, J. H. N81-12967
TREINISH, L. N81-12762
TRENCHARD, M. H. N81-12478
N81-12489
TREVINO, S. F. N81-12443
TRISTRANT, D. N81-12112
TROTTER, J. D. N81-12327
N81-12329
TUCKER, J. V. N81-12799
TUFTS, D. N81-12813
TURNER, M. R. N81-12119

U

UCCELLINI, L. W. N81-12678
UELAND, M. N81-12585
ULLMAN, J. D. N81-12334
UNDERWOOD, J. H. N81-12456
URPO, S. N81-12126

V

VAHALA, G. N81-12896
VAHRENKAMP, R. P. N81-12397
VALENTIAN, D. N81-12165
VALENTINO, A. R. N81-12705
VALERY, P. N81-12522
VALLEY, M. N81-12414
VANCLEAVE, J. R. N81-12054
VANCLEAVE, R. A. N81-12417
VANDAM, C. P. N81-12012
VANDAM, T. N81-12584
VANDENBERG, B. N81-12036
VANDERHOEVEN, W. N81-12081
VANDERMEER, J. N81-12404
VANDERMEULEN, H. N81-12434
VANDERSIJDE, K. A. N81-12187
VANGESTEL, G. F. J. A. N81-12473
VANKUIKEN, J. C. N81-12621
VANMANSART, M. N81-12112
VEDAM, K. N81-12597
VELDMAN, A. E. P. N81-12382
VENKAYYA, V. B. N81-12077
VERGER, F. N81-12501
VERHOEF, W. N81-12538
VERINGA, J. H. N81-12902
VERSCHUUR, K. A. N81-12902
VETTER, R. N81-12415
VIRDEE, L. N81-12152
VISSCHER, W. M. N81-12872
VIVIAND, H. N81-12372
VLIEGER, H. N81-12475
VOGH, J. W. N81-12268
VONSCHWERDTNER, O. A. N81-12998
VONTIESENHAUSEN, G. N81-12283
VOSS, A. W. N81-12485
VOSS, P. N81-12925
VOTRUBA, J. N81-12316
VRANAS, T. N81-12390
VRANOS, A. N81-12255
VROMAN, A. N81-12158

W

WADE, M. J. N81-12905
WADE, T. E. N81-12327
WAGNER, U. N81-12931
WALBRIDGE, E. W. N81-12592
WALD, L. N81-12501
WALL, J. S. N81-12400
WALTER, L. S. N81-12525
WALTHER, R. N81-12626
WALTON, M. N81-12508
WALZ, J. E. N81-12445
WANG, C. H. N81-12866
WANG, J. T. N81-12781
WANG, T. G. N81-12357
WANHILL, R. J. H. N81-12081
N81-12474
N81-12477
WARBURTON, J. D. N81-12700
WARSI, Z. U. A. N81-12017
WASILIK, J. N81-12868
WATTS, C. N81-12414
WATTS, V. N81-12809
WEBER, B. A. N81-12867
WEBER, J. N81-12907
WEED, R. A. N81-12017
WELKER, J. R. N81-12189
WELLS, C. N81-12264
WELPMANN, K. N81-12222
WENDEL, A. H. N81-12147
N81-12148
WENZEL, K. P. N81-12992
WERNER, C. N81-12536
WERTH, L. F. N81-12506
WESSEL-BERG, T. N81-12340
WEST, B. S. N81-12050
WEWERINKE, P. H. N81-12742
N81-12743
WHITE, C. L. N81-12920
WHITE, G. T., III N81-12072
WHITE, N. E. N81-12974
WHITE, S. N. N81-12837
WHITELAW, J. H. N81-13008
WHITMAN, R. B. N81-12059
WHITMORE, R. A., JR. N81-12492
WHITNEY, S. C. N81-12643
WIBERG, K. B. N81-12168
WICHMANN, B. A. N81-12788
WIDMANN, D. N81-12346
WIEDERHORN, S. M. N81-12231
N81-12232
WIJKER, J. J. N81-12471
WILDGOOSE, P. N81-12209
WILFONG, D. E. N81-12230
WILHELM, K. N81-12080
WILLIAMS, B. R. N81-12038
WILLIAMS, D. E. N81-12218
WILLIAMS, J. H. N81-12643
WILLIAMS, R. C. N81-12084
WILLMANN, G. N81-12629
WILLNER, I. N81-12842
WILSON, G. N81-12158
WILSON, G. E. N81-12550
WILSON, W. I. N81-12280
WILSON, W. R. D. N81-12233
WINIGER, M. T. N81-12191
WINSTON, M. M. N81-12039
WINSTON, R. N81-12874
WINTER, J. J. N81-12333
WINTER, K. G. N81-12037
WINTUCKY, E. G. N81-12817
WISLER, D. C. N81-12086
WITMER, E. A. N81-12427
WITTING, K. N81-12396
WITTMER, V. N81-13002
WOLF, J. D. N81-12298
WOLFE, C. M. N81-12913
WOLTERS, F. C. N81-12228
WONG, D. N81-12215
WOODGER, M. N81-12768
WOODWARD, P. W. N81-12268
WOODWARD, S. N81-12932
WORTHY, J. G. B. N81-12082
WRAY, W. O. N81-12625
WRIGHT, I. G. N81-12213
WROBLESKI, J. T. N81-12911
N81-12912
WULF, R. H. N81-12085

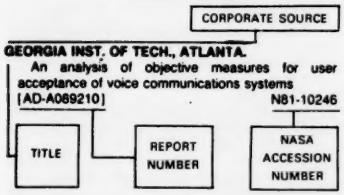
Y

YAMAMURA, Y. K. N81-12650
YANG, L. C. N81-12646
YANG, S. H. N81-12172
YAU, W. F. N81-12290
YBARRA, A. H. N81-12026
YEE, Y. P. N81-12411
YEH, R. T. N81-12766
YEN, C. N81-12784
YI-HUI, D. N81-12689
YOSHIKARA, S. N81-12895
YOUNG, F. C. N81-12848
YOUNG, J. B. N81-12692
YOUNG, M. E. N81-12934
YOUNG, M. I. N81-12446
YU, Y. H. N81-12824
YURICK, E. M. N81-12954
YUROW, J. H. N81-12933

Z

ZAFRAN, S. N81-12162
ZAK, A. R. N81-12787
ZANDBERGEN, T. N81-12033
ZANIO, K. N81-12616
ZECKAU, C. N81-12420
ZELLER, J. R. N81-12099
ZIEMBA, E. J. N81-12141
ZIMMERMAN, D. C. N81-12936
ZIZAK, G. N81-13012

Typical Corporate Source Index Listing



Listings in this index are arranged alphabetically by corporate source. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The titles are arranged under each corporate source in ascending accession number order.

A

ABERDEEN PROVING GROUND, MD.
Electron microscopy for fracture mode identification
[AD-A090412] N81-12457

ACUREX CORP., MOUNTAIN VIEW, CALIF.
Development of a low-cost solar panel using laminated polymer films
[ALO-4121-2] N81-12577

An automatic isokinetic sampler for particulate emissions from aircraft gas turbine engines
[AD-A090280] N81-12653

ADMINISTRATIVE SCIENCES CORP., FALLS CHURCH, VA.
Naval aircraft operating and support cost-estimating model: FY78 revision
[AD-A090044] N81-12013

ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT, NEUILLY-SUR-SEINE (FRANCE).
Report on a cooperative programme on Active Flutter Suppression
[AGARD-R-689] N81-12115

AGARD index of publications 1977-1979
[AGARD-INDEX-77-79] N81-12935

Testing and measurement techniques in heat transfer and combustion
[AGARD-CP-281] N81-12993

AERITALIA S.P.A., TORINO (ITALY).
BIRAMIS satellite definition study. Volume 1: Executive summary
[ESA-CR(P)-1354-VOL-1] N81-12128

BIRAMIS satellite definition study. Volume 2: Technical study
[ESA-CR(P)-1354-VOL-2] N81-12129

Study of heat rejection systems
[TC-80-TR-0050] N81-12379

AEROJET LIQUID ROCKET CO., SACRAMENTO, CALIF.
Orbit Transfer Vehicle (OTV) engine phase A study, extension 1. Volume 3: Study cost estimates
[NASA-CR-161608] N81-12161

AERONAUTICAL RESEARCH ASSOCIATES OF PRINCETON, INC., N. J.
The 1980 status report on low-level, atmospheric turbulence model for marine environments
[AD-A090576] N81-12701

AERONAUTICAL RESEARCH INST. OF SWEDEN, STOCKHOLM.
Static and fatigue testing of precision cast steel and aluminum
[FFA-TN-HU-2106] N81-12223

Application of a method for aerodynamic analysis and design of horizontal axis wind turbines, part 1
[FFA-TN-AU-1499-PT-1] N81-12633

Nonlinear finite element analysis: An alternative formulation
[FFA-TN-HU-2189-PT-2] N81-12801

AEROSPACE CORP., EL SEGUNDO, CALIF.
Commuter air carrier loan guarantee study
[AD-A090615] N81-12047

Reduction and analysis of ATS-6 data
[NASA-CR-160052] N81-12683

AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ.
Heat Capacity Mapping Mission (HCMM)
[E81-10020] N81-12497

Heat Capacity Mapping Mission (HCMM)
[E81-10021] N81-12498

AIR FORCE ACADEMY, COLO.
B-52 wake investigation
[LOG-C3932] N81-12020

AIR FORCE AERO PROPULSION LAB., WRIGHT-PATTERSON AFB, OHIO.
Future Air Force aircraft propulsion control systems: The extended summary paper N81-12096

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FLA.
The vapor phase autoxidation of unsymmetrical dimethylhydrazine and 50 percent unsymmetrical dimethylhydrazine 50 percent hydrazine mixtures
[AD-A090281] N81-12261

USAF Aircraft Engine emission goals, a critical review
[AD-A090282] N81-12651

The implications of alternative aviation fuels on airbase air quality
[AD-A090283] N81-12652

AIR FORCE FLIGHT DYNAMICS LAB., WRIGHT-PATTERSON AFB, OHIO.
Optimal design studies on composite wings with static and dynamic constraints
[AAAF-NT-79-29] N81-12077

Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort N81-12116

Application of fracture mechanics to US Air Force aircraft structural integrity requirements
[AAAF-NT-79-25] N81-12463

AIR FORCE FLIGHT TEST CENTER, EDWARDS AFB, CALIF.
Flight test handbook: Flying qualities theory and flight test techniques
[AD-A090525] N81-12073

AIR FORCE GEOPHYSICS LAB., HANSCOM AFB, MASS.
Interlevel correlations of temperature and density, surface to 60 km
[AD-A090515] N81-12130

Spacecraft charging on ATS-5
[AD-A090508] N81-12147

Groundbased predictors of spacecraft charging during eclipse passage
[AD-A090338] N81-12148

A one dimensional vertical diffusion parameter for extremely inhomogeneous, layered turbulence in stratified fluids
[AD-A090340] N81-12364

Hemispheric asymmetries detected from satellite ionization gauge measurements
[AD-A090339] N81-12685

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Time dependent Navier-Stokes solution of a turbulent gas jet ejected from a rectangular orifice into a high-subsonic cross flow
[AD-A090343] N81-12365

Viscoplastic and creep crack growth analysis by the finite element method
[AD-A090344] N81-12450

The use of the finite element method in meteorological modelling
[AD-A090761] N81-12700

Cathodoluminescence characterization of ion implanted GaAs
[AD-A090302] N81-12914

AIRCRAFT RESEARCH AND DEVELOPMENT UNIT, EDINBURG (AUSTRALIA).
Pilatus porter: Provision of revised take-off and landing performance data
[AD-A089964] N81-12068

AIRESEARCH MFG. CO., PHOENIX, ARIZ.
Low-cost directionally-solidified turbine blades, volume 2
[NASA-CR-159562] N81-12088

AIRESEARCH MFG. CO., TORRANCE, CALIF.
Evaluation of filament-wound Kevlar-49/epoxy fatigue properties
[UCRL-15264] N81-12224

AMAF INDUSTRIES, COLUMBIA, MD.
Coal conversion engineering analysis for Central Hudson Gas and Electric Corporation, Danskammer Generating Station, units 3 and 4
[DOE/RG-10075/T1] N81-12269

AMERICAN ASSOCIATION FOR VOCATIONAL INSTRUCTIONAL MATERIALS, ATHENS, GA.
Providing for energy efficiency in homes and small buildings. Part 1: Understanding and practicing energy conservation in buildings
[DOE/IR-06065/1-PT-1] N81-12582

AMERICAN ELECTRONIC LABS., INC., LANSDALE, PA.
Low cost airborne microwave landing system receiver, task 3
[NASA-CR-152409] N81-12054

AMERICAN NATIONAL STANDARDS INST., NEW YORK.
Solar standards coordinated by the Steering Committee on Solar Energy Standards Development contents
[DOE/CS-30118/T3] N81-12596

AMES DESIGN COLLABORATIVE, IOWA.
Experimental and theoretical study of thermal performance of a hybrid solar system at Living History Farms
[DOE/CS-34136/1] N81-12606

AMES LAB., IOWA.
Electrotransport of solutes in refractory metals
[IS-4722] N81-12218

Pressure vessels for coal liquefaction: An overview
[IS-M-282] N81-12429

Electronic band structure and optical properties of the cubic, Sc, Y and La hydride systems
[IS-T-899] N81-12918

Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923

Effect of pressure on the superconducting and magnetic critical temperatures of bct ternary ruthenium borides
[IS-M-293] N81-12924

APPLIED SOLAR ENERGY CORP., CITY OF INDUSTRY, CALIF.

Third generation design solar cell module LSA task 5, large scale production
[NASA-CR-163809] N81-12554

Automated linear concentrator cell module assembly
[SAND-80-7103] N81-12610

APPLIED TECHNOLOGY CORP., NORMAN, OKLA.

Effectiveness of fire control agents on chemical fires. Phase 1: Test methodology and baseline hexane tests
[AD-A089585] N81-12189

ARGONNE NATIONAL LAB., ILL.

Sampling and analysis of hydrocarbons in combustion gases
[ANL/CEN/FE-80-11] N81-12204

Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212

Corrosion and mechanical behavior of materials for coal gasification applications
[ANL-80-5] N81-12216

Grain ethanol as a petroleum substitute: A perspective
[ANL/SPG-9] N81-12279

Support studies in fluidized-bed combustion
[ANL/CEN/FE-79-14] N81-12280

Lagrangian three-dimensional finite-element formulation for the nonlinear fluid-structural response of reactor components
[ANL-80-26] N81-12461

Laser satellite power systems
[ANL/ES-92] N81-12592

High-performance batteries for electric-vehicle propulsion and stationary energy storage
[ANL-79-94] N81-12614

Methods of chemical analysis used to characterize battery materials
[ANL-80-41] N81-12615

Development of nondestructive evaluation techniques for high-temperature ceramic heat exchanger components
[ANL/MSD/FE-80-4] N81-12617

Ecological and biomedical effects of effluents from near-term electric vehicle storage battery cycles
[ANL/ES-90] N81-12619

Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620

Reliability, energy, and cost effects of wind powered generation integrated with a conventional generating system
[ANL/AA-17] N81-12621

Argonne solar energy program. Summary of solar program activities
[ANL-80-80] N81-12622

In pursuit of clean air: A data book of problems and strategies at the state level. Volume 3: Federal regions 4 and 6
[ANL/EES-TM-90-VOL-3] N81-12656

An assessment of the atmospheric effects of a satellite power system
[CONF-791204-39] N81-12705

Informal workshop on intense polarized ion sources: A summary
[ANL-80-73] N81-12854

MHD heat and seed recovery technology project
[ANL/MHD-80-1] N81-12898

ARMY AEROMEDICAL RESEARCH LAB., FORT RUCKER, ALA.

Evaluation of Army aviator human factors, fatigue, in a high threat environment
[AD-A090751] N81-12730

SPH-4 helmet damage and head injury correlation
[AD-A090750] N81-12740

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, ABERDEEN PROVING GROUND, MD.

GRID and CQUAD: Two preprocessing codes for NASTRAN
[AD-A090664] N81-12460

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, DOVER, N. J.

Evaluation of an available gyrocompassing land navigation to provide an artillery shoot and move capability
[AD-A090733] N81-12060

Molecular level modeling of the mechanism of shock initiation of solid explosives
[AD-A090427] N81-12263

A reaction mechanism in the shock initiation of detonation: A theoretical study
[AD-A090357] N81-12264

Nondestructive testing of armament-system components by means of neutron diffraction
[AD-A090433] N81-12443

Nonlinear chi-square algorithm: An improvement on nonlinear least squares
[AD-A090420] N81-12792

ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND, WATERVLIET, N. Y.

Benefits of overload for fatigue cracking at a notch
[AD-A090698] N81-12456

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, CLEVELAND, OHIO.

The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210

ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND, ST. LOUIS, MO.

LR-80 flight test report
[AD-A090284] N81-12058

ARMY AVIONICS RESEARCH AND DEVELOPMENT ACTIVITY, FORT MONMOUTH, N. J.

Army GPS-doppler hybrid navigation system
[AD-A090394] N81-12062

ARMY COMBAT SURVEILLANCE AND TARGET ACQUISITION LAB., FORT MONMOUTH, N. J.

A new technique for Doppler frequency analysis of radar signals
[AD-A090435] N81-12314

ARMY COMMUNICATIONS RESEARCH AND DEVELOPMENT COMMAND, FORT MONMOUTH, N. J.

Correlation and prediction of propagation time-delays along earth-space links
[AD-A090441] N81-12313

Coding and processing for reliable data transmission
[AD-A090406] N81-12315

ARMY COMPUTER SYSTEM COMMAND, FORT BELVOIR, VA.

Pulse code modulation of CO2 tea laser pulse
[AD-A090436] N81-12412

ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND, FORT MONMOUTH, N. J.

Spatial coherence and intensity properties of quasihomogeneous optical sources
[AD-A090378] N81-12413

Second harmonic generation of near millimeter wave radiation by nonlinear bulk material
[AD-A090351] N81-12906

ARMY ELECTRONICS TECHNOLOGY AND DEVICES LAB., FORT MONMOUTH, N. J.

Combat hardened communications: High precision frequency control using resonators immune to acceleration and stress fields
[AD-A090361] N81-12332

Semi-insulating gallium arsenide for millimeter wave and high speed IC device applications
[AD-A090437] N81-12333

Fundamental limitations of electron beam lithography for future military IC fabrication
[AD-A090407] N81-12336

Millimeter-wave self mixing oscillators
[AD-A090384] N81-12337

The charge and discharge behavior of molybdenum trioxide electrodes in lithium perchlorate propylene carbonate electrolyte
[AD-A090346] N81-12568

Large high quality single crystal aluminum phosphate for acoustic wave devices
[AD-A090359] N81-12905

ARMY ENGINEER TOPOGRAPHIC LABS., FORT BELVOIR, VA.

Detection of signal signatures of cartographic features
[AD-A090375] N81-12531

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.

A Terrain-vehicle model for analysis of steerability of tracked vehicles
[AD-A090360] N81-12424

ARMY MATERIALS AND MECHANICS RESEARCH CENTER, WATERTOWN, MASS.

Acoustic emission as a NDE technique for determining composite rotor blade reliability
[AD-A090440] N81-12070

Laser interaction with TBR materials
[AD-A090429] N81-12177

Proceedings of the Army symposium on solid mechanics. Designing for extremes: Environment, Loading, and Structural Behavior
[AD-A090684] N81-12285

Opening session addresses presented at the Army symposium on solid mechanics. Designing for extremes: Environment, loading, and structural behavior
[AD-A090686] N81-12286

Work-in-progress presented at the Army symposium on solid mechanics, 1980, designing for extremes: Environment, loading, and structural behavior
[AD-A090685] N81-12287

Transparent, polycrystalline cubic aluminum oxide
[AD-A090418] N81-12870

ARMY MISSILE COMMAND, REDSTONE ARSENAL, ALA.

Field evaluation of the ANS-2000 land navigation system
[AD-A090793] N81-12061

Three dimensional finite element combustion instability analysis
[AD-A090396] N81-12194

Low temperature X-ray diffraction investigation of embrittled minimum signature CHAPARRAL propellant
[AD-A090356] N81-12256

Frequency diverse tracking/guidance millimeter radar adapted to target acquisition
[AD-A090355] N81-12305

Micom program in optical bistability
[AD-A090366] N81-12865

ARMY MOBILITY EQUIPMENT COMMAND, FORT BELVOIR, VA.

The adsorption and electrooxidation of simple hydrocarbons for direct oxidation hydrocarbon air fuel cells
[AD-A090377] N81-12569

Effects of low power microwaves on the local cerebral blood flow of conscious rats
[AD-A090426] N81-12720

ARMY NATICK RESEARCH AND DEVELOPMENT COMMAND, MASS.

The penetration of nylon ballistic panels by fragment simulating projectiles. Part 2: Mechanism of penetration
[AD-A090341] N81-12425

ARMY RESEARCH AND TECHNOLOGY LABS., FORT EUSTIS, VA.

Status of improved autorotative landing capability research
[AD-A090431] N81-12072

On the use of active higher harmonic blade pitch control for helicopter vibration reduction
[AD-A090398] N81-12074

ARMY RESEARCH AND TECHNOLOGY LABS., MOFFETT FIELD, CALIF.

Stability of nonuniform rotor blades in hover using a mixed formulation
[AD-A090756] N81-12071

Transonic rotor noise - theoretical and experimental comparisons
[AD-A090806] N81-12624

ATLANTIC RESEARCH CORP., GAINESVILLE, VA.

Effects of advances in propulsion technology on missile effectiveness
[AD-A090645] N81-12106

ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON (ENGLAND).

Modeling of compressed magnetic field generators by equivalent circuit approach
[AWRE-O-21/80] N81-12351

The 1976 earthquake sequence in Uzbekistan: Focal mechanisms determined using the relative amplitude method
[AWRE-O-27/80] N81-12692

Data acquisition from a digital voltmeter using a CBM PET 2001 microcomputer with particular reference to microelectronic wire bond testing
[AWRE-O-16/80] N81-12753

AUBURN UNIV., ALA.
Placement techniques for the standard transistor array (Star)
[NASA-CR-150901] N81-12326

AVCO SYSTEMS DIV., WILMINGTON, MASS.
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427

AVIONS MARCEL DASSAULT-BREGUET AVIATION, SAINT-CLOUD (FRANCE).
Mirage 2000 and Mirage 4000 fiber structures
[AAAF-NT-79-44] N81-12183

B

BABCOCK AND WILCOX CO., LYNCHBURG, VA.
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738-1/2] N81-12600

BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD.
Computational parametric study of the aerodynamics of spinning slender bodies at supersonic speeds
[AD-A090443] N81-12027
Spin jet damping of rocket-assisted projectiles
[AD-A089980] N81-12142

BALLISTIC SYSTEMS DIV., NORTON AFB, CALIF.
A comparison of Navier-Stokes computations with experimental data for a projectile shape at transonic velocities
[AD-A090424] N81-12023
The initiation of explosive charges by rapid shear
[AD-A090391] N81-12257
Burning rate transitions for HMX burned as a binderless propellant
[AD-A090389] N81-12258

BATTELLE COLUMBUS LABS., OHIO.
Correlation of the high-temperature corrosion behavior of structural alloys in coal conversion environments with the components of the alloys and of the corrosive environments
[BMI-2059] N81-12213
Assessment of the potential of colloidal fuels in future energy usage
[DOE/ER-10062/T1] N81-12271
Sorghums as energy crops
[CONF-800482-5] N81-12534

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH.
Heliostat mirror survey and analysis
[PNL-3194] N81-12609
DOE candidate site meteorological measurement program
[PNL-SA-7840] N81-12704
Evaluation of several methods for assessing the effects of occupational exposure to radiation
[PNL-SA-8438] N81-12733

BAYERN-CHEMIE G.M.B.H., OTTOBRUNN (WEST GERMANY).
Kinetics of ionization in NaCl-contaminated argon
[LOG-J6857] N81-12188

BDM CORP., MCLEAN, VA.
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547
Point Focusing Thermal and Electric Applications Project. Volume 2: Workshop proceedings
[NASA-CR-163804] N81-12548

BEET SUGAR DEVELOPMENT FOUNDATION, FORT COLLINS, COLO.
Evaporation by mechanical vapor recompression
[BSDF-38-3Q-80] N81-12195

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BENDIX CORP., DETROIT, MICH.
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N81-12102

BENDIX CORP., KANSAS CITY, MO.
Simultaneous measurement of multilayered composites
[BDX-613-2407] N81-12178
X-ray fluorescence analysis of metal concentration in an alloy electroplating bath
[BDX-613-2411] N81-12205
Thin film gold etchant formulation and rinse removal
[BDX-613-2393] N81-12206
Thin film corrosion
[BDX-613-2435] N81-12217
The improvement of external lead bond and flexure strengths by comparing lead base materials
[BDX-613-2339] N81-12219
Bonding silicons with epoxies
[BDX-613-2432] N81-12240
Evaluation of improved polyamides
[BDX-613-2354] N81-12241
Phenolic resin syntactic foams
[BDX-613-2408] N81-12244
Moisture penetration evaluation of polystyrene bead foam as an encapsulant for electronic packages
[BDX-613-2394] N81-12245
Test methods for the dynamic mechanical properties of polymeric materials
[BDX-613-2405] N81-12246
Deburring: Technical capabilities and cost-effective approaches, lessons 5 and 6
[BDX-613-2382] N81-12288
Whole new world of miniature technology
[BDX-613-2277] N81-12289
Multilayer printed wiring board lamination
[BDX-613-2422] N81-12341
Comparison of metallization systems for thin film hybrid microcircuits
[BDX-613-2489] N81-12344
Hybrid microcircuit via development
[BDX-613-2395] N81-12345
Laser cutting plastic materials
[BDX-613-2476] N81-12417
Laser applications
[BDX-613-2448] N81-12418
Effects of xenon cover gas in CO2 laser welding
[BDX-613-2442] N81-12430
Ultrasonic seam welding
[BDX-613-2444] N81-12431
Resistance spot welding of Ti-6Al-4V alloy
[BDX-613-2447] N81-12432
Quadric solids and computational geometry
[BDX-613-2484] N81-12794

BICKLE/CM, INC., ALBUQUERQUE, N. MEX.
Performance data for passive systems. The National Center for Appropriate Technology test rooms
[SERI/TR-0924-3] N81-12586

BLACK AND VEATCH CONSULTING ENGINEERS, KANSAS CITY, MO.
Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma
[DOE/SF-10738/1-3] N81-12598
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[DOE/SF-10738-1/2] N81-12600

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Design studies for a far infrared absolute spectrometer for the cosmic background explorer
[NASA-CR-160051] N81-12385

BOEING AEROSPACE CO., SEATTLE, WASH.
New techniques for test development for tactical auto-pilots using microprocessors
[AD-A090641] N81-12149
Peripheral cues and color in visual simulation
[AD-A089837] N81-12726

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Assessment of variable camber for application to transport aircraft
[NASA-CR-158430] N81-12016
Aircraft surface coatings study: Energy efficient transport program
[NASA-CR-158954] N81-12225

BOEING MILITARY AIRPLANE DEVELOPMENT, SEATTLE, WASH.
Should we attempt global (inlet engine airframe) control design? N81-12097

BOEING VERTOL CO., PHILADELPHIA, PA.
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[AD-A090675] N81-12075
Conveyorized radio frequency cure of epoxy glass composites
[AD-A089728] N81-12176

BRITISH AEROSPACE AIRCRAFT GROUP, BRISTOL (ENGLAND).
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Microchannel plate as a detector of minimum ionizing particle
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The APEX accelerator cycle for transmutation of long-lived fission wastes
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Optical fibers and avalanche photodiodes for scintillator counters
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BROWN AND ROOT, INC., HOUSTON, TEX.
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558

BROWN UNIV., PROVIDENCE, R. I.
Parameter identification techniques for physiological control systems
[AD-A090547] N81-12728
Existence of optimal controls for partially observed diffusions
[AD-A090537] N81-12778
Stochastic approximation with discontinuous dynamics and state dependent noise w.p.1 convergence
[AD-A089777] N81-12805
Asymptotic behavior for a strongly damped nonlinear wave equation
[AD-A090548] N81-12814

BUSINESS AND TECHNOLOGICAL SYSTEMS, INC., SEABROOK, MD.
Equivalent source modeling of the main field using Magsat data
[E81-10026] N81-12503

C

CALIFORNIA INST. OF TECH., PASADENA.
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[AD-A090588] N81-12830

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[NASA-CR-160037] N81-12175
Electromagnetic waves scattering by buried dielectric objects
[AD-A090582] N81-12308
Surface nonlinear optics
[LBL-11252] N81-12875

CALIFORNIA UNIV., BERKELEY. LAWRENCE BERKELEY LAB.
Software standards in chemistry
[LBL-9881] N81-12169
Surface and catalysis science in the Materials and Molecular Research Division
[DOE/TIC-11225] N81-12202
A15 multifilamentary superconductors by the infiltration process
[LBL-10761] N81-12342
Physical and optical properties of rare earth cobalt magnets
[LBL-11393] N81-12818
Beam-beam simulation for the single-pass collider
[LBL-10755] N81-12834
Algorithms and computer codes for atomic and molecular quantum scattering theory, volume 2
[LBL-9501-VOL-2] N81-12835
Vectorially photoinduced electron-transfer processes across water-on-oil interfaces of microemulsions
[LBL-11232] N81-12842
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[LBL-11320] N81-12859
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Surface nonlinear optics
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Microstructure and domain structure of PZT
[LBL-10651] N81-12917

CALIFORNIA UNIV., LIVERMORE. LAWRENCE LIVERMORE LAB.
State-of-the-art review of flywheel burst containment
[UCRL-15257] N81-12427
Open-loop heliostat reflector
[UCID-18764] N81-12587
Computational physics program of the National MFE Computer Center
[UCID-175530-REV-1] N81-12927

CALIFORNIA UNIV., LOS ANGELES.
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[AD-A090810] N81-12888

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[E81-10022] N81-12499

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Studying the exhaust gas from a post combustion turbojet engine N81-12996

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[UR-3490-1900] N81-12732

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French space programs for 1979 N81-12127

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[AAAF-NT-80-09] N81-12030

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[AAAF-NT-80-04] N81-12374
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CENTRO INFORMAZIONI STUDI ESPERIENZE, MILAN (ITALY).
Laser like approach to the dynamics of convective instabilities
[CISE-1533] N81-12371
Measurement by an automated holographic system of strain distribution in test specimens of composite structural materials
[CISE-1529] N81-12403
High accuracy distance measurement by two-wavelength pulsed laser source
[CISE-N-189] N81-12419
A multiprocessor system for creep fatigue test monitoring
[CISE-1531] N81-12462
High efficiency GaAs-GaAlAs solar cells for very high concentration systems
[CISE-1517] N81-12630
The CISE tandem vandeGraaf accelerator and its fields of use
[CISE-N-191] N81-12820
Dynamic test of a mechanical model using a coherent light vibration sensor
[CISE-N-192] N81-12877
A computer program for line profile simulations of a laser produced plasma
[CISE-N-187] N81-12901

CHALMERS UNIV. OF TECHNOLOGY, GOTEBORG (SWEDEN).
Maximizing the intersection density of fiber processes
[CTH-MATH-1980-4] N81-12185
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[CTH-MATH-1980-5] N81-12810
A historically motivated study of families of Pythagorean or Babylonian triples and their generating semigroups of p- or b-orthonormal matrices
[CTH-MATH-1980-3] N81-12815
A characterization of Gorenstein orders in quaternion algebras
[CTH-MATH-1980-6] N81-12816

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[DOE/ET-14858/2] N81-12266

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[DOE/ER-10575/1] N81-12874
Adsorption of oxygen on the tungsten (110) plane at low temperatures. Spectroscopic measurements
[AD-A090603] N81-12904
Adsorption of oxygen on the (110) plane of tungsten at low temperatures
[AD-A090604] N81-12915

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[CRI-110] N81-12752

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[AD-A090497] N81-12453
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[AD-A090335] N81-12741

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[SERI/SP-98156-1] N81-12952

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[AD-A089937] N81-12303

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[AD-A090496] N81-12831
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[ORO-5260-4] N81-12896

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[DOE/ET-14881/2] N81-12273

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[DOE/EV-01340/T2] N81-12657
Parametrization of net radiation at the surface using data from the Wangara experiment
[DOE/EV-01340/T3] N81-12688
Role of the Qinghai-Xizang plateau in feedback mechanisms affecting the planetary circulation
[COO-1340-74] N81-12689
Further study of the variability in the frequency of typhoon formation over the West Pacific ocean
[COO-1340-75] N81-12702
Variability within the ocean-atmospheric system over the North Pacific
[DOE/EV-01340/T1] N81-12703

COLORADO UNIV., BOULDER.
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[NASA-CR-161612] N81-12123

COLUMBIA UNIV., NEW YORK.
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[NASA-CR-165145] N81-12139

COLUMBUS TECHNICAL INST., OHIO.
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[NASA-CR-161589] N81-12544

COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
System design of advanced carbide fuel
[COO-2426-205] N81-12265

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French space programs for 1979 N81-12127

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Agricultural waste products as alternative energy sources
[GPO-62-991] N81-12561
Energy research and extension
[GPO-61-544] N81-12562

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Space shuttle and Galileo mission
[GPO-53-938] N81-12940

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION (U. S. SENATE).
Aviation safety
[GPO-68-717] N81-12040
Laser research and applications
[GPO-66-074] N81-12406
Ocean thermal energy conversion act of 1980
[GPO-64-551] N81-12565
The Moon treaty
[GPO-66-705] N81-12937
Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-68-636] N81-12939
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The Western Hemisphere energy system
[GPO-51-683] N81-12557
COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE (U. S. HOUSE).
Priority energy project act of 1979
[GPO-58-154] N81-12555
Clean air act-amendments of 1977: Oversight
[GPO-63-136] N81-12648
COMMITTEE ON POST OFFICE AND CIVIL SERVICE (U. S. HOUSE).
Air traffic controllers and flight service station specialists
[GPO-51-381] N81-12055
COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION (U. S. HOUSE).
Review of title 5 of the National Energy Conservation Policy Act
[GPO-57-523] N81-12563
COMMITTEE ON SCIENCE AND TECHNOLOGY (U. S. HOUSE).
Oversight hearing: United States Metric Board
[GPO-56-236] N81-12284
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[GPO-61-252] N81-12566
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[GPO-60-580] N81-12567
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[GPO-56-764] N81-12849
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[GPO-68-972] N81-12938
United States civilian space policy
[GPO-66-883] N81-12941
Storage batteries for electric vehicle applications
[GPO-57-671] N81-12945
Key issues in US-USSR scientific exchanges and technology transfer
[GPO-50-111] N81-12946
Technology transfer to China
[GPO-58-034] N81-12947
Technology transfer to China
[GPO-62-976] N81-12948
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Commuter airport safety
[GPO-60-512] N81-12041
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[AAAF-NT-80-23] N81-12032
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[DOE/EV-10303/5] N81-12731
CORNELL UNIV., ITHACA, N. Y.
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[AD-A090776] N81-12190
Two-phase critical flow of saturated and subcooled liquids through valves
[ANL/RAS/LWR-79-7] N81-12370
X-ray holography with X-rays
[AD-A090807] N81-12393
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
Probe measurements in multi-dimensional reacting flows N81-12997
COUNCIL OF EUROPE, STRASBOURG (FRANCE).
Proposals to use micro-accelerometers for space geodetic experiments
[ESA-CR(P)-1371] N81-12160
COURY AND ASSOCIATES, INC., LAKEWOOD, COLO.
Residential and commercial space heating and cooling with possible greenhouse operation: Baca Grande development, San Luis Valley, Colorado
[DOE/ET-28455/3] N81-12604

D

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Rationalization of power subsystem design specifications for ESA spacecraft
[ESA-CR(P)-1348] N81-12163
DAYTON UNIV., OHIO.
Transonic flow computations with separate treatment of the subsonic and supersonic regions
[AD-A090327] N81-12025
Effects of bird orientation at impact on load profile and damage level
[AD-A090676] N81-12050
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[NASA-CR-165169-VOL-1] N81-12135
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book, volume 2
[NASA-CR-165169-VOL-2] N81-12136
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 3: User form surveys
[NASA-CR-165169-VOL-3] N81-12137
Applications Technology Satellite and Communications Technology Satellite user experiments for 1967-1980 reference book. Volume 4: Abstracts
[NASA-CR-165169-VOL-4] N81-12138
Solar heating and cooling system installed at Columbus, Ohio
[NASA-CR-161589] N81-12544
Solar heating system installed at Troy, Ohio
[NASA-CR-161588] N81-12545
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[AD-A090572] N81-12738
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[AD-A090771] N81-12779
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[DOE/BETC-RI-80/1] N81-12268
Exhaust and evaporative emissions from gasohol-type fuels
[DOE/BETC-RI-80/7] N81-12270
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[DOE/EV-0094] N81-12201
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[DOE/IA-0010/2] N81-12588
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[CONF-800383] N81-12590
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[DOE/EA-0117] N81-12655
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[DOE/NE-0007-SUPPL-1] N81-12855
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[DOE-TR-229] N81-12951
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[DFVLR-MITT-80-01] N81-12035
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[ESA-CR(P)-1359] N81-12380
Technical assistance for the evaluation of fluid loop components (Peltier cooler)
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Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537
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[DP-MS/79-78] N81-12290
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[ANL/OEPM-79-10] N81-12953
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[NASA-CR-161604] N81-12134
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
ENVIRONMENTAL RESOURCES GROUP, LOS ANGELES, CALIF.
Prototype environmental assessment of the impacts of siting and constructing a Satellite Power System (SPS)
[DOE/ER-0072] N81-12659
ERNO RAUMFAHRTTECHNIK G.M.B.H., BREMEN (WEST GERMANY).
Evaluation of an electrothermal hydrazine gas generator for attitude control of spacecraft
[VB-0421018-B] N81-12164
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA (SWITZERLAND).
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[DOE/ER-02232/90] N81-12840
EUROPEAN SPACE AGENCY, PARIS (FRANCE).
Investigation of landing flare in the presence of wind shear
[ESA-TT-631] N81-12080
Three component measurements on a body with various afterbody configurations in subsonic and transonic flow
[ESA-TT-628] N81-12151
Chemical reactions in turbulent medium
[ESA-TT-638] N81-12207
Influence of thermomechanical treatment on microstructure and mechanical properties of high-strength aluminum alloys
[ESA-TT-507] N81-12222
A new method of roundness measurement by capacitative detectors
[ESA-TT-635] N81-12292
Investigation into the sensitive parameters in a quartz oscillator
[ESA-TT-636] N81-12352
Remote sensing methods for the determination of slant range visibility
[ESA-TT-627] N81-12536
Contribution to the study of the internal mechanics of a space photovoltaic generator
[ESA-STR-205] N81-12631
Optical and atmospheric optical parameters during visibility tests in the north of Germany, 1977
[ESA-TT-615] N81-12690
Some results of preliminary tests on values of sky-sea contrast (visible horizon) as a function of environmental parameters
[ESA-TT-623] N81-12691
Spectral analysis of nonstationary random processes. Application to noise of flyover type
[ESA-TT-639] N81-12826
Activities of the Space Science Department in 1978/1979
[ESA-SP-1032] N81-12992
EUROPEAN SPACE RESEARCH AND TECHNOLOGY CENTER, NOORDWIJK (NETHERLANDS).
Flammability testing
[ESA-PSS-26/QRM-21T-ESTEC-ISS-2] N81-12208
Evaluation of a conductive adhesive system for the grounding of aluminized Kapton coated with indium/tin oxide
[ESA-STM-213] N81-12251
EXXON RESEARCH AND ENGINEERING CO., LINDEN, N.J.
Development of evaluation techniques for electrochemical energy storage systems
[CONS-5157-T1] N81-12589

F

FAIRBROTHER AND GUNTHER, INC., GRAND RAPIDS, MICH.
Solar hot water space heating system
[DOE/CS-34412/18] N81-12584
FEDERAL AVIATION ADMINISTRATION, WASHINGTON, D.C.
IFR aircraft handled forecast by air route traffic control center, fiscal years 1980-1991
[AD-A090803] N81-12048
FEDERAL COMPILER TESTING CENTER, WASHINGTON, D.C.
Honeywell information systems, COBOLA 2.0, level 6, MOD 0400 COBOL compiler
[PB80-204969] N81-12759
FERMI NATIONAL ACCELERATOR LAB., BATAVIA, ILL.
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[FERMILAB-CONF-79/85-EXP] N81-12843
FIAT RESEARCH CENTER, TURIN (ITALY).
Current and future needs for engine electronic control sensors N81-12435
FINNISH NATIONAL COMMITTEE OF COSPAR, OTANIEM.
Space activities in Finland in 1979 N81-12126
FOM-INSTITUUT VOOR PLASMAFYSICA, JUTPHAAS (NETHERLANDS).
A reactor study on a belt-shaped screw pinch
[REPT-73-76] N81-12902
FORD MOTOR CO., DEARBORN, MICH.
HC quench layer formation in combustion processes
[DOE/ET-15303/T4] N81-12198
HC quench layer formation in combustion processes
[DOE/ET-15303/T3] N81-12199
Ford/DOE sodium-sulfur battery electric vehicle development and demonstration, phase 1-A
[COO-2566-53-T1] N81-12950
FRANKLIN PIERCE LAW CENTER, CONCORD, N. H.
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[DOE/RA-04934/05] N81-12611
FREIBURG UNIV. (WEST GERMANY).
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[E81-10005] N81-12482
FRIEDRICHSFELD G.M.B.H., MANNHEIM (WEST GERMANY).
Production technology of beta-alumina ceramics for Na/S batteries
[BMFT-FB-T-79-57] N81-12629

G

GALILEO ELECTRO-OPTICS CORP., STURBRIDGE, MASS.
Fiber optic combiner and duplicator
[NASA-CR-160044] N81-12864
GENERAL ACCOUNTING OFFICE, WASHINGTON, D. C.
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[AD-A090520] N81-12928
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.
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[NASA-CR-161597] N81-12133
GENERAL ELECTRIC CO., CINCINNATI, OHIO.
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[NASA-CR-159499] N81-12086
GENERAL ELECTRIC CO., EVENDALE, OHIO.
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[NASA-CR-159867] N81-12085
GENERAL ELECTRIC CO., SCHENECTADY, N. Y.
The study of turbulent diffusion flames: Modeling needs and experimental light scattering capabilities N81-13011
GENERAL ELECTRIC CO., ST. PETERSBURG, FLA.
Axial compression testing of vacuum tube glass ceramic/molybdenum frames
[GEPP-TIS-503] N81-12238
Microstructure examination of the interface of the glass-ceramic insulator of the molybdenum frame of a vacuum tube
[GEPP-TIS-516] N81-12239
GENERAL ELECTRIC CO., UTICA, N. Y.
Wideband multiplex system
[AD-A090770] N81-12312
GENERAL ELECTRIC CO., WASHINGTON, D. C.
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[DOE/CS-20189/1] N81-12593
GENERAL MOTORS CORP., INDIANAPOLIS, IND.
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[AD-A090546] N81-12108
GEOLOGICAL SURVEY, MINNEAPOLIS, MINN.
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GEORGIA INST. OF TECH., ATLANTA.
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[NASA-CR-163788] N81-12675
Optimal resource placement in a distributed system (extended abstract)
[AD-A090772] N81-12780
GINER, INC., WALTHAM, MASS.
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[DOE/CS-3107/T2] N81-12215
GOETEBORG UNIV. (SWEDEN).
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[CTH-MATH-1980-6] N81-12816
GOULD-BROWN BOVERI, GREENSBURG, PA.
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[EPRI-EL-1500] N81-12368
GRENOBLE UNIV. (FRANCE).
Calculations for nonstationary laminar flow subject to an average deceleration with shearing
[AAAF-NT-80-02] N81-12373
GROUPE DE RECHERCHE DE CHIMIE PHYSIQUE DE LA COMBUSTION, ST. JULIEN L'ARS (FRANCE).
Study of space micropropulsion by hydrazine thermal decomposition. Laboratory tests
[AAAF-NT-80-28] N81-12281

H

HARRIS CORP., MELBOURNE, FLA.
Microwave integrated circuits procedures evaluation
[AD-A090677] N81-12338
HARRY DIAMOND LABS., ADELPHI, MD.
Gigawatt microwave emission from a relativistic reflex triode
[AD-A090598] N81-12335
The extension of (Hg, Cd)Te detector technology to the near millimeter spectral region
[AD-A090449] N81-12867
Nuclear radiation effects in fiber-optic waveguides
[AD-A090439] N81-12868
HEBREW UNIV., JERUSALEM (ISRAEL).
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[AD-A090287] N81-12833

HONEYWELL CORPORATE MATERIAL SCIENCES CENTER, BLOOMINGTON, MINN.
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[AD-A090589] N81-12234
HONEYWELL SYSTEMS AND RESEARCH CENTER, MINNEAPOLIS, MINN.
Reference manual for the ADA programming language, proposed standard document
[AD-A090709] N81-12768
HUGHES AIRCRAFT CO., TORRANCE, CALIF.
Large signal TWT computer theory
[AD-A090748] N81-12340
HUGHES RESEARCH LABS., MALIBU, CALIF.
Pulse power switch development
[AD-A090511] N81-12339
Direct-write ion lithography
[AD-A090607] N81-12397
Indium phosphide/cadmium sulfide thin-film solar cells
[SERI/PR-8170-1-T1] N81-12616
HYCOM, INC., IRVINE, CALIF.
Tactical video display
[AD-A089992] N81-12302

I

IIT RESEARCH INST., CHICAGO, ILL.
Recommended hazard classification procedures for in process propellant and explosive material
[AD-A090674] N81-12260
ILLINOIS STATE UNIV., NORMAL.
An algorithm module for abstract algebra
N81-12803
ILLINOIS UNIV. AT URBANA-CHAMPAIGN.
Fluid mechanical processes of Deflagration to detonation transition in beds of porous reactive solids
[AD-A090558] N81-12262
ILLINOIS UNIV. AT URBANA-CHAMPAIGN, URBANA.
Characterization of internal boundary layer capacitors
[DOE/ER-01198/1311] N81-12916
ILLINOIS UNIV., URBANA.
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[AD-A089985] N81-12787
IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND).
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[IC-AERO-80-01] N81-12378
Velocity and temperature measurements in a premixed flame within an axisymmetric combustor
N81-13006
INSIGHTS WEST, INC., LOS ANGELES, CALIF.
Solar-augmented applications in industry
[PB80-205313] N81-12643
INSTITUT D'AERONOMIE SPATIALE DE BELGIQUE, BRUSSELS.
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[AERONOMICA-ACTA-A-206-1979] N81-12670
A microscopic description of interpenetrated plasma regions
[AERONOMICA-ACTA-A-209-1979] N81-12671
On eddy diffusion coefficients
[AERONOMICA-ACTA-A-212-1980] N81-12672
Nitric oxide cooling in the terrestrial thermosphere
[AERONOMICA-ACTA-A-214-1980] N81-12673
Stratospheric layering photographed
[AERONOMICA-ACTA-C-54-1979] N81-12674
Derivation of zero-dimensional from one-dimensional climate models
[AERONOMICA-ACTA-A-208-1979] N81-12696
Impulsive penetration of solar wind plasma and its effects on the upper atmosphere
[AERONOMICA-ACTA-A-207-1979] N81-12971
Observation of the solar ultraviolet radiation
[AERONOMICA-ACTA-A-211-1980] N81-12972
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[BMFT-FB-DV-79-05] N81-12931
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, AVIGNON (FRANCE).
The evaluation of evaporation by infrared thermography: A critical analysis of the measurements on the Crau test site
[E81-10039] N81-12521
Contribution to agronomical applications of remote sensing: Analysis of the relations between the structure of a vegetation coverage, its physiological state, and radiometric data N81-12535
INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, VERSAILLES (FRANCE).
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[E81-10040] N81-12522
INSTITUT NATIONAL DES SCIENCES APPLIQUEES DE LYON, VILLEURBANNE (FRANCE).
Sheared zone considerations in incompressible turbulent boundary layer calculations
[AAAF-NT-80-03] N81-12355
INSTITUTE FOR TELECOMMUNICATION SCIENCES, BOULDER, COLO.
Propagation in a tropospheric duct with a single-step discontinuity in the refractive index in the direction of propagation
[AD-A090544] N81-12306
INSTITUTE OF GAS TECHNOLOGY, CHICAGO, ILL.
Wastes and biomass as energy resources
[CONF-790512-1] N81-12570
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[E81-10023] N81-12500
INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS, ROME (ITALY).
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N81-12708
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N81-12709
The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A N81-12710
INTERNATIONAL RESEARCH AND TECHNOLOGY CORP., MCLEAN, VA.
Indirect liquefaction of coal
[DOE/EV-10291/T1] N81-12274
IOWA STATE UNIV. OF SCIENCE AND TECHNOLOGY, AMES.
Superconductivity and long range magnetic order in the body-centered tetragonal system Er(Rh/sub 1-x/Ru/sub x)4B4
[IS-M-295] N81-12923
ITT AEROSPACE/OPTICAL DIV., FORT WAYNE, IND.
AVHRR/1-FM Advanced Very High Resolution Radiometer
[NASA-CR-160059] N81-12392

J

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
Rotating liquid drops: Plateaus experiment revisited
[NASA-CR-163745] N81-12357
Overall requirements for an advanced underground coal extraction system
[NASA-CR-163748] N81-12523
Point Focusing Thermal and Electric Applications Project. Volume 1: Executive summary
[NASA-CR-163803] N81-12547
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[NASA-CR-163804] N81-12548
An industrial application of the JPL ACTS with energy recovery
[NASA-CR-163807] N81-12550
Solar silicon via the Dow Corning process
[NASA-CR-163798] N81-12551
High-voltage spark carbon-fiber sticky-tape data analyzer
[NASA-CR-163747] N81-12646
Analysis of air quality management with emphasis on transportation sources
[NASA-CR-163746] N81-12647
Aerodynamic design of electric and hybrid vehicles: A guidebook
[NASA-CR-163744] N81-12943
Vehicle systems design optimization study
[NASA-CR-163797] N81-12944
Hybrid vehicle potential assessment. Volume 9: Power train summary, component descriptions, and HYVEC vehicle simulator
[CONS-4209-T1-VOL-9] N81-12949
JPL's electric and hybrid vehicles project: Project activities and preliminary test results N81-12987
The DOE photovoltaics program N81-12989
JOHNS HOPKINS UNIV., BALTIMORE, MD.
Ultrasonic and acoustic emission detection of fatigue damage
[AD-A090799] N81-12440
JOINT ECONOMIC COMMITTEE (U. S. CONGRESS).
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[GPO-61-316] N81-12649

K

KANSAS UNIV. CENTER FOR RESEARCH, INC., LAWRENCE.
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[AD-A090500] N81-12310
KARLSRUHE UNIV. (WEST GERMANY).
Correlation measurement of velocity and temperature fluctuations in a free jet diffusion flame
N81-13002
KEMA (N. V.), ARNHEM (NETHERLANDS).
A reactor study on a belt-shaped screw pinch
[REPT-73-76] N81-12902
KENTRON INTERNATIONAL, INC., HAMPTON, VA.
Induced drag ideal efficiency factor of arbitrary lateral-vertical wing forms
[NASA-CR-3357] N81-12022
KRAFTWERK UNION A.G., MULHEIM (WEST GERMANY).
Application of model laws when determining the heat transfer coefficients by experiments on cooled turbine blades N81-12998

L

LABORATORIUM FUER BETRIEBSFESTIGKEIT, DARMSTADT (WEST GERMANY).
Current developments in aircraft fatigue evaluation procedures
[AAAF-NT-79-33] N81-12464
LAMONT-DOHERTY GEOLOGICAL OBSERVATORY, PALISADES, N. Y.
Observations of position, ocean depths, and gravity taken from the FRAM 2 and Camp 1 drifting ice stations
[AD-A090711] N81-12687
LEHIGH UNIV., BETHLEHEM, PA.
Two-dimensional transient hygrothermal stresses in bodies with circular cavities: Moisture and temperature coupling effects
[AD-A090626] N81-12454
Transient hydrothermal and mechanical stress intensities around elliptical cavities
[AD-A090625] N81-12455
LETTERMAN ARMY INST. OF RESEARCH, SAN FRANCISCO, CALIF.
Laboratory investigations of biomedical factors influencing laser designator operator performance
[AD-A090425] N81-12739
LEXINGTON LABS., INC., CAMBRIDGE, MASS.
Convergence of iterative nonexpansive signal reconstruction algorithms
[NASA-CR-163799] N81-12790
LIBRARY OF CONGRESS, WASHINGTON, D. C.
Energy from municipal solid wastes
[GPO-61-252] N81-12566
Agreement governing the activities of states on the Moon and other celesial bodies, part 4
[GPO-68-636] N81-12939

LILLE UNIV. (FRANCE).
Sea surface temperature of the coastal zones of France
[E81-10024] N81-12501
LINCOLN LAB., MASS. INST. OF TECH., LEXINGTON.
Error analysis of pursuit and proportional navigation control laws
[AD-A090155] N81-12056
Artificial satellites, minor planets, and the ETS
[AD-A089823] N81-12143
Acoustoelectric devices: A new technology for waveform-agile radar
[AD-A090646] N81-12311
Efficient multipliers for the FFT
[AD-A090648] N81-12789
LITTLE (ARTHUR D.), INC., CAMBRIDGE, MASS.
Solar power satellite offshore rectenna study
[NASA-CR-3348] N81-12558
GaAlAs/GaAs solar cell process study
[NASA-CR-3361] N81-12564
An evaluation of superconducting magnetic energy storage
[ANL-K-79-4917-1] N81-12618
LITTON SYSTEMS, INC., WOODLAND HILLS, CALIF.
Ring laser gyro
[AD-A090643] N81-12395
LOCKHEED-CALIFORNIA CO., BURBANK.
YF-12 Cooperative Airframe/Propulsion Control System program, volume 1
[NASA-CR-163099] N81-12067
LOCKHEED ENGINEERING AND MANAGEMENT SERVICES CO., INC., HOUSTON, TEX.
Canadian crop calendars in support of the early warning project
[E81-10001] N81-12478
As-built design specification for proportion estimate software subsystem
[E81-10002] N81-12479
Houston area multicrop inspection trips
[E81-10003] N81-12480
Proportion estimation using prior cluster purities
[E81-10006] N81-12483
Earth Observations Division version of the Laboratory for Applications of Remote Sensing System (EOD-LARSYS) user guide for the IBM 370/148. Volume 2: User reference manual
[E81-10010] N81-12487
As-built design specification for P1A software system modified display subsystem
[E81-10011] N81-12488
Crop calendars for the US, USSR, and Canada in support of the early warning project
[E81-10012] N81-12489
Supplemental US/Canada wheat and barley exploratory experiment implementation plan: Evaluation of a procedure 1A technology
[E81-10031] N81-12513
Minimum variance geographic sampling
[E81-10033] N81-12515
Estimation of within-stratum variance for sample allocation: Foreign commodity production forecasting
[E81-10034] N81-12516
Stratum variance estimation for sample allocation in crop surveys
[E81-10035] N81-12517
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF.
Study of a solid hydrogen cooler for spacecraft instruments and sensors
[NASA-CR-160056] N81-12157
LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CALIF.
Producing the high temperature reusable surface insulation for the thermal protection system of the Space Shuttle
[AAAF-NT-79-42] N81-12154
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Thermochemical cycles: A new method of producing hydrogen
[LASL-80-26] N81-12275
Thickening of a shock front by the grain structure of a solid
[LA-8410-MS] N81-12369
DYMAC digital electronic balance
[LA-8313-M] N81-12398
Passive solar design calculations with the DOE-2 computer program
[LA-UR-80-2340] N81-12624
Quantitative comparison of passive solar simulation codes
[LA-UR-80-2267] N81-12625
Graphs of the cross sections in the Alternate Monte Carlo Cross Section library at the Los Alamos Scientific Laboratory
[LA-8394-MS] N81-12793
Graphs of the cross sections in the recommended Monte Carlo cross section library at the Los Alamos Scientific Laboratory
[LA-8374-MS] N81-12847
Application of MOOT to scattering of elastic waves from compound inclusions
[LA-UR-80-2039] N81-12872
Search for faint galactic features
[LA-UR-80-2357] N81-12960

M

MAINE UNIV., ORONO.
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663
MARTIN MARIETTA AEROSPACE, ORLANDO, FLA.
SWIFT
[AD-A090647] N81-12343
MARYLAND UNIV., COLLEGE PARK.
A comparative analysis of functional correctness
[AD-A090487] N81-12767
Investigation of noise in solids at low temperatures
[AD-A090805] N81-12907
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Properties of some diblock copolymers based on 1,3 butadiene monomer
[AD-A090144] N81-12230
Failure detection system design methodology
[NASA-CR-163792] N81-12439
Optimized pitch controller for load alleviation on wind turbines
[FFA-TN-HU-2189-PT-1] N81-12634
Application of gas lasers to studies of fundamental molecular and atomic processes
[AD-A090336] N81-12829
Simulation of the structure of vacancies in high angle grain boundaries
[COO-5002-10] N81-12919
MASSACHUSETTS UNIV., AMHERST.
Studies of polyurethanes and epoxy curing reactions
[AD-A089947] N81-12229
Lubrication by solid coating in hydrostatic extrusion
[AD-A090583] N81-12233
Nonparametric tests of independence for censored data
[AD-A090330] N81-12806
MCDONNELL-DOUGLAS ASTRONAUTICS CO., HUNTINGTON BEACH, CALIF.
AMARV high reliability piece part
[AD-A090577] N81-12441
Solar total energy modularity study
[SAND-80-7060] N81-12608
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., MUNICH (WEST GERMANY).
Space structure today and tomorrow
[AAAF-NT-79-46] N81-12078
MESSERSCHMITT-BOELKOW-BLOHM G.M.B.H., OTTOBRUNN (WEST GERMANY).
Spaceborne laser range and range rate finder
[ESA-CR(P)-1367] N81-12420
MESSERSCHMIDT-BOELKOW G.M.B.H., MUNICH (WEST GERMANY).
Active control of an explosive wing-store flutter case N81-12117
MIAMI UNIV., CORAL GABLES, FLA.
Development of Boolean calculus and its applications
[NASA-CR-163802] N81-12786
MIDWEST RESEARCH INST., GOLDEN, COLO.
Research into the pyrolysis of pure cellulose, lignin, and birch wood flour in the China Lake entrained-flow reactor
[SERI/TR-332-586] N81-12196
US Department of Energy solar thermal energy systems program. An overview presentation
[SERI/SP-733-526] N81-12572
Open cycle OTEC system with falling jet evaporator and condenser
[SERI/TP-631-791] N81-12573
Investigation of simple daily solar radiation models suitable for use in the design of solar heating systems
[SERI/RR-721-675] N81-12574
Systems analysis of thermal storage
[SERI/TP-631-841] N81-12575
Annual-cycle thermal energy storage for a community solar system: Details of a sensitivity analysis
[SERI/TR-721-575] N81-12576
Solar energy in Australia: A profile of renewable energy activity in its national context
[SERI/SP-763] N81-12578
MIDWEST RESEARCH INST., KANSAS CITY, MO.
Assessment of energy and economic impacts of particulate control technologies in coal-fired power generation
[ANL/ECT-9] N81-12620
MILITARY VEHICLES AND ENGINEERING ESTABLISHMENT, CHRISTCHURCH (ENGLAND).
Test track facilities
[MVEE-MEMO-79021] N81-12122
MILTON KEYNES DEVELOPMENT CORP., (ENGLAND).
Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses
[ERG-031] N81-12632
MILWAUKEE SCHOOL OF ENGINEERING, WIS.
The investigation into hydraulic gear pump efficiencies in the first few hours of the pumps' lives and a comparative study of accelerated life tests methods on hydraulic fluid power gear pumps, part 3
[AD-A089848] N81-12423
MINNESOTA UNIV., DULUTH.
Measurement of suspended solids in lakes and oceans using satellite remote sensing data N81-12510
MINNESOTA UNIV., MINNEAPOLIS.
A study of Minnesota land and water resources using remote sensing, volume 13
[E81-10028] N81-12505
Remote sensing and image interpretation
[E81-10036] N81-12518
Introduction to the study of collisions between heavy nuclei
[DOE/ER-10364/12] N81-12853
MINNESOTA UNIV., ST. PAUL.
LANDSAT applications to wetlands classification in the upper Mississippi River Valley N81-12506
Development of alternative data analysis techniques for improving the accuracy and specificity of natural resource inventories made with digital remote sensing data N81-12507
A project to evaluate moisture stress in corn and soybean areas of western and southwestern Minnesota N81-12509
MISSISSIPPI STATE UNIV., MISSISSIPPI STATE.
On the solution of the unsteady Navier-Stokes equations for hypersonic flow about axially-symmetric blunt bodies
[NASA-CR-161609] N81-12017
Full scale visualization of the wing tip vortices generated by a typical agricultural aircraft
[NASA-CR-159382] N81-12019
A study of trends and techniques for space base electronics
[NASA-CR-161277] N81-12327
Trends and techniques for space base electronics
[NASA-CR-150825] N81-12329
MITRE CORP., BEDFORD, MASS.
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[AD-A090606] N81-12791
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[DOE/ET-27224/T1] N81-12658
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Formulation and evaluation of C-Ether fluids as lubricants useful to 260 C
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MOTOREN- UND TURBINEN-UNION MUENCHEN G.M.B.H. (WEST GERMANY).
Technical suppositions developed for smoke measurements during high pressure full annular combustor tests and engine trials N81-12995

MOTOROLA, INC., PHOENIX, ARIZ.
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[NASA-CR-163806] N81-12549
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[DOE/SERI/8229-3/2-T6] N81-12602

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Spinning plasma ring stable to tilting mode
[IPPJ-478] N81-12884
Two dimensional behavior of solitons in a low-b plasma with convective motion
[IPPJ-480] N81-12885
Anomalous deceleration of light ion beam in plasma of inertial confinement fusion
[IPPJ-479] N81-12886
NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH COUNCIL, WASHINGTON, D. C.
Remote Sensing For Water Resources And Hydrology. Recommended research emphasis for the 1980's
[NASA-CR-163791] N81-12529
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A conservative implicit finite difference algorithm for the unsteady transonic full potential equation
[NASA-TM-81211] N81-12018
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[NASA-NEWS-RELEASE-80-192] N81-12964
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The effect of thermal stresses on the integrity of three built-up aircraft structures
[NASA-TM-81352] N81-12064
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[NASA-TP-1748] N81-12066
In-flight boundary-layer measurements on a hollow cylinder at a Mach number of 3.0
[NASA-TP-1764] N81-12361
User's manual for MMLE3, a general FORTRAN program for maximum likelihood parameter estimation
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Shoreline as a controlling factor in commercial shrimp production
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A method for the processing and analysis of digital terrain elevation data
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Method of and apparatus for damping nutation motion with minimum spin axis attitude disturbance
[NASA-CASE-GSC-12551-1] N81-12156
An analysis of short pulse and dual frequency radar techniques for measuring ocean wave spectra from satellites
[NASA-TM-82011] N81-12296
Vector analogues of the Maggi-Rubinowicz theory of edge diffraction
[NASA-TM-82024] N81-12297
Multi-mode horn antenna simulation
[NASA-TM-80705] N81-12298
Non-contacting power transfer device
[NASA-CASE-GSC-12595-1] N81-12331
Interferometric angle monitor
[NASA-CASE-GSC-12614-1] N81-12386
Multiprism collimator
[NASA-CASE-GSC-12608-1] N81-12387
Off-axis coherently pumped laser
[NASA-CASE-GSC-12592-1] N81-12407
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A physical basis for remote rock mapping of igneous rocks using spectral variations in thermal infrared emittance
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Magsat vector magnetometer calibration using Magsat geomagneti, field measurements
[NASA-TM-82046] N81-12527
Inverting x,y grid coordinates to obtain latitude and longitude in the vanderGrinten projection
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A description of the NSSL cases used for a simulated VAS retrieval study
[NASA-TM-82023] N81-12678
The aeronomy of vibrationally excited ozone
[NASA-TM-82025] N81-12679
Crustal dynamics project observing plan for highly mobile systems 1981 - 1986
[NASA-TM-82029] N81-12680
Energetics of the magnetosphere
[NASA-TM-82039] N81-12681
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The dynamics of oceanic fronts. Part 1: The Gulf Stream
[NASA-TM-80335-PT-1] N81-12717
Comparison of and conversion between different implementations of the FORTRAN programming language
[NASA-TM-81995] N81-12762
Looking for heavier weak bosons with DUMAND
[NASA-TM-82027] N81-12828
Electrostatic heat flux instabilities
[NASA-TM-82008] N81-12882
White dwarf models for type 1 supernovae and quiet supernovae, and presupernova evolution
[NASA-TM-82030] N81-12957
Observation of the core of the Perseus cluster with the Einstein solid state spectrometer: Cooling gas and elemental abundances
[NASA-TM-82038] N81-12958
Future prospects for gamma-ray
[NASA-TM-82041] N81-12959
An X-ray survey of nine historical novae
[NASA-TM-82014] N81-12961
Pulsar gamma-rays: Spectra luminosities and efficiencies
[NASA-TM-82026] N81-12962
Magnetic field directional discontinuities. 2: Characteristics between 0.46 and 1.0 AU
[NASA-TM-82036] N81-12963
Jupiters magnetopause, bow shock, and 10-hour modulated magnetosheath: Voyagers 1 and 2
[NASA-TM-82033] N81-12965
The formation of arcs in the dynamic spectra of Jovian decameter bursts
[NASA-TM-81987] N81-12966
Energetic particles in the pre-dawn magnetotail of Jupiter
[NASA-TM-81991] N81-12967
Observations of the magnetic field and plasma flow in Jupiter's magnetosheath
[NASA-TM-82035] N81-12968
On the origin of multiply-impulsive emission from solar flares
[NASA-TM-82013] N81-12973
The discovery of an 81 minute modulation of the X-ray flux from 2A0311-227
[NASA-TM-82037] N81-12974
Super-alfvenic propagation of cosmic rays: The role of streaming modes
[NASA-TM-82032] N81-12975
Experiments on the effect of ultraviolet on contamination in vacuum systems
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.
Illustration of year-to-year variation in wheat spectral profile crop growth curves
[E81-10032] N81-12514
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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. JOHN F. KENNEDY SPACE CENTER, COCOA BEACH, FLA.
Fiber optic crossbar switch for automatically patching optical signals
[NASA-CASE-KSC-11104-1] N81-12862
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, HAMPTON, VA.
Flight evaluation of the effect of winglets on performance and handling qualities of a single-engine general aviation airplane
[NASA-TM-81892] N81-12012
Low-speed aerodynamic characteristics of a 13 percent thick medium speed airfoil designed for general aviation applications
[NASA-TP-1498] N81-12015
Experimental and theoretical aerodynamic characteristics of two hypersonic cruise aircraft concepts at Mach numbers of 2.96, 3.96, and 4.63
[NASA-TP-1767] N81-12021
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[NASA-TM-81886] N81-12039
A simulator study for the development and evaluation of operating procedures on a supersonic cruise research transport to minimize airport-community noise
[NASA-TP-1742] N81-12043
Simulation comparison of a decoupled longitudinal control system and a velocity vector control wheel steering system during landings in wind shear
[NASA-TP-1734] N81-12109
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort
N81-12116
A technology development program for large space antennas
[NASA-TM-81902] N81-12155
Experimental investigation of graphite/polyimide sandwich panels in edgewise compression
[NASA-TM-81895] N81-12173
Process for preparing high temperature polyimide film laminates
[NASA-CASE-LAR-12742-1] N81-12174
An improved viscous characteristics analysis program
[NASA-TP-1289] N81-12356
Heat pipe honeycomb panel
[NASA-CASE-LAR-12637-1] N81-12362
Miniature spectrally selective dosimeter
[NASA-CASE-LAR-12469-1] N81-12388
Pyroelectric detector arrays
[NASA-CASE-LAR-12363-1] N81-12389
Hot foil transducer skin friction sensor
[NASA-CASE-LAR-12321-1] N81-12390
Modified spiral wound retaining ring
[NASA-CASE-LAR-12361-1] N81-12422
Deployable and erectable concepts for large spacecraft
[NASA-TM-81904] N81-12445
Dynamic response of a forward-swept-wing model at angles of attack up to 15 deg at a Mach number of 0.8
[NASA-TM-81863] N81-12448
Genesis of breath sounds-Preliminary verification of theory
[NASA-TM-81897] N81-12719
Acoustic tooth cleaner
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Guidelines in preparing computer-generated plots for NASA technical reports with the LRC graphics output system
[NASA-TM-81908] N81-12761
Optimal regulation in systems with stochastic time sampling
[NASA-TP-1743] N81-12812
A comparison of the three methods used to obtain acoustic measurements for the NASA Flight Effects Program
[NASA-TM-81906] N81-12822
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[NASA-TP-1178] N81-12084
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[NASA-TP-1716] N81-12089
Propulsion Controls, 1979
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Multivariable identification using centralized fixed modes N81-12091
Performance seeking controls N81-12092
F100 multivariable control synthesis program: A review of full scale engine altitude tests N81-12093
Propulsion control and control theory: A new research focus N81-12099
Laminates and reinforced metals
[NASA-TM-81591] N81-12171
The role of oxidation in the fretting wear process
[NASA-TM-81570] N81-12210
NiCrAl ternary alloy having improved cyclic oxidation resistance
[NASA-CASE-LEW-13339-1] N81-12211
Effect of load, area of contact, and contact stress on the wear mechanisms of a bonded solid lubricant film
[NASA-TM-81563] N81-12226
Turbulent solution of the Navier-Stokes equations
[NASA-TM-81621] N81-12358
Curved film cooling admission tube
[NASA-CASE-LEW-13174-1] N81-12363
Stability of large horizontal-axis axisymmetric wind *turbines*
[NASA-TM-81623] N81-12446
Solar cell system having alternating current output
[NASA-CASE-LEW-12808-2] N81-12542
Theoretical model applicable to the experimental determination of surface anchoring energies of nematic *liquid crystals*
[NASA-TM-81628] N81-12817
Acoustic transmission matrix of a variable area duct *or nozzle carrying a compressible subsonic flow*
[NASA-TM-81614] N81-12821
Impact for the 80's: Proceedings of a Conference *on Selected Technology for Business and Industry*
[NASA-CP-2149] N81-12978
Energy overview N81-12979
NASA Research in aeropropulsion N81-12980
Large wind turbines: A utility option for the generation of electricity N81-12981
Progress in materials and structures at Lewis Research Center N81-12982
Thin-film coatings N81-12983
Self-lubricating composite materials N81-12984
Propulsion system research and development for *electric and hybrid vehicles N81-12985*
The Federal electric and hybrid vehicle program N81-12986
Coal gasifier cogeneration powerplant project N81-12988
Solar photovoltaics: Stand alone applications *N81-12990*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT *CENTER, HUNTSVILLE, ALA.*

Beam connector apparatus and assembly
[NASA-CASE-MFS-25134-1] N81-12283
The MSFC silicon gate silicon-on-sapphire standard cell library
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[NASA-TM-78192] N81-12325
Three phase power factor controller
[NASA-CASE-MFS-25535-1] N81-12330
Theoretical regime diagrams for thermally driven flows in a beta-plane channel in the presence of variable gravity
[NASA-TM-78316] N81-12676
The large scale microelectronics Computer-Aided Design and Test (CADAT) system
[NASA-TM-78202] N81-12747
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[NLR-TR-77104-U] N81-12033
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[NLR-TR-79063-U] N81-12034
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[NLR-MP-79034-U] N81-12036
Developments in aircraft structural materials
[NLR-MP-79042-U] N81-12081
Residual strength of multi-ply carbon/epoxy Kevlar-carbon/epoxy notched laminates
[AAAF-NT-79-34] N81-12179
Residual strength of multi-ply carbon/epoxy and Kevlar-carbon/epoxy notched laminates
[NLR-MP-79016-U] N81-12186
Investigation of impact damage in sandwich panels with face sheets of composite materials
[NLR-TR-79011-U] N81-12187
Compilation of test data from an investigation on the influence of environmental aging and displacement rate on crack resistance of adhesives
[NLR-TR-79020-U] N81-12252
A calculation method for incompressible boundary layers with strong viscous-inviscid interaction
[NLR-MP-79029-U] N81-12382
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[NLR-MP-77026-U] N81-12473
Manual for the AGARD-coordinated Corrosion Fatigue Cooperative Testing Program (CFCTP)
[NLR-MP-79017-U] N81-12474
Application of fracture mechanics to built-up structures
[NLR-MP-79044-U] N81-12475
Two simple methods for deformation demonstration and measurement
[NLR-MP-80002-U] N81-12476
Flight simulation environmental fatigue crack propagation in 2024-T3 and 7475-T761 aluminum
[NLR-MP-80003-U] N81-12477
An improved feature selection criterion and its application to multispectral reflectance data from crops
[NLR-TR-79002-U] N81-12538
Mathematical models of pilot-helicopter systems
[NLR-MP-79026-U] N81-12742
Visual scene perception in manual control
[NLR-MP-79045-U] N81-12743
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[NLR-MP-78017-U] N81-12802

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[PB80-208390] N81-12668

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[PB80-813785] N81-12637
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[PB80-814130] N81-12639
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[PB80-813397] N81-12640
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[PB80-813389] N81-12641
Solar energy concentrator design and operation. Citations from the Engineering Index data base
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[PB80-813462] N81-12665
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[PB80-813470] N81-12666
Airport noise. Citations from the NTIS data base
[PB80-813231] N81-12667

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Read only memories. Citations from the NTIS data base
[PB80-814833] N81-12757
Computer storage management. Citations from NTIS data base
[PB80-814759] N81-12758
Programming language design. Citations from the NTIS data base
[PB80-814767] N81-12773
Automatic programming. Citations from the NTIS data base
[PB80-813637] N81-12774
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[PB80-813702] N81-12783
Pattern recognition and image processing. Citations from the NTIS data base
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[PB80-814221] N81-12785
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[PB80-814841] N81-12934
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[NRL-MR-4322] N81-12848
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[AD-A090775] N81-12451

NORTH CAROLINA UNIV. AT CHAPEL HILL.

In search of correlation in multiplicative congruential generators with modulus (2 to the 31st power) minus 1
[AD-A090636] N81-12808
On limiting distributions of intermediate order statistics from stationary sequences
[AD-A090617] N81-12809

NORTHROP CORP., HAWTHORNE, CALIF.

Astroinertial navigation for cruise applications
[AD-A090649] N81-12059
Wind tunnel test of a fighter aircraft wing/store flutter suppression system: An international effort
N81-12116

NOTRE DAME UNIV., IND.

Alternatives for jet engine control N81-12103

O

OAK RIDGE NATIONAL LAB., TENN.

Progress toward analytical description of the creep strain-time behavior engineering alloys
[CONF-800907-2] N81-12214
Testing program for determining the mechanical properties of concrete to temperatures of 621 C
[CONF-800969-1] N81-12459
Tracking of smokestack and cooling tower plumes using wind measurements at different levels
[ORNL/TM-7417] N81-12654
Reviews of the environmental effects of pollutants: IX, fluoride
[ORNL/EIS-85] N81-12660
Determination of coefficients for the universal laws of friction and heat transfer for CFTL calculations
[ORNL/TM-7418] N81-12819
Rigid muffin-tin approximation for the electron-phonon interaction in transition metals
[CONF-800864-1] N81-12839
State-of-the-art report on low-level radioactive waste treatment
[ORNL/TM-7427] N81-12858
Using packaged software for solving two differential equation problems that arise in plasma physics
[CONF-800699-4] N81-12891
Grain boundary segregation and intergranular failure
[CONF-8005109-1(DRAFT)] N81-12920
Czochralski growth of single-crystal gehlenite Ca2Al2SiO7
[CONF-800908-2] N81-12921
Coherent absorption and emission processes penetrating crystals
[CONF-800859-3] N81-12922

OAKLAND UNIV., ROCHESTER, MICH.

A uniform representation of single and multi-stage interconnection networks used in SIMD machines
[AD-A089688] N81-12300

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AERONAUTIQUES, PARIS (FRANCE).

A method for measuring short time response by *determining velocity and temperature variations in high* temperature flows N81-13005

OFFICE NATIONAL D'ETUDES ET DE *RECHERCHES AEROSPATIALES, LECLERC* (FRANCE).

Test and analyses of an active flutter suppression *system on an FFDL model of YF17* *N81-12118*

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).

BIRAMIS: Numerical evaluation of the overall system precision
[ONERA-RT-7/3373-SY] N81-12159
Numerical resolution of diffusion and propagation problems in the parabolic approximation context
[ONERA-P-1978-5] N81-12318
Method for calculating two dimensional sheared flow at high Reynolds numbers
[AAAF-NT-80-01] N81-12372
Mixed variational principles for static problems coupling these principles with the displacement principle
[ONERA-NT-1980-2] N81-12467
The GMC system for central memory management
[ONERA-NT-1979-12] N81-12751
Description and utilization of a computation program *of the optical radiation transmitted, emitted or diffused* by the atmosphere for satellite observation
[ONERA-NT-1980-3] N81-12878
Diagnosing combustion by D.R.A.S.C. *N81-13009*

OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, D. C.

Aeronautics and Space Report of the President, *1979 activities* N81-12956

OHIO STATE UNIV., COLUMBUS.

Reference coordinate systems for Earth dynamics: *A preview* [NASA-CR-163800] N81-12525

Accuracy of the determination of mean anomalies *and mean geoid undulations from a satellite gravity* field mapping mission [REPT-307] N81-12669

OLD DOMINION UNIV., NORFOLK, VA.

Effects of boundary-layer treatment on cryogenic wind-tunnel controls [NASA-CR-159372] N81-12120

Modeling and control of transonic cryogenic wind tunnel: A summary report [NASA-CR-159376] N81-12121

Influence of nonequilibrium radiation and shape change on aerothermal environment of Jovian entry body [NASA-CR-163795] N81-12140

OPEN UNIV., MILTON (ENGLAND).

Passive solar in Milton Keynes, England. A description of some of the more numerical aspects of the design of an estate of low energy houses [ERG-031] N81-12632

OPERATIONS RESEARCH, INC., SILVER SPRING, MD.

Alternative transportation fuels [CONF-800419-5] N81-12267

OPTICAL COATING LAB., INC., CITY OF INDUSTRY, CALIF.

Development of high efficiency (14 percent) solar *cell array module* [NASA-CR-163808] N81-12553

OREGON STATE UNIV., CORVALLIS.

Eighth year projects and activities of the Environmental Remote Sensing Applications Laboratory (ERSAL) [E81-10013] N81-12490

The application of remotely sensed data in support of emergency rehabilitation of wildfire-damage areas [E81-10014] N81-12491

Wave power extraction from a transient heaving cylinder [DOE/ET-21019/T1] N81-12599

Study of roughness-induced diffuse and specular reflectance at silver-air and silver-liquid interfaces [COO-4381-10] N81-12873

OXFORD UNIV. (ENGLAND).

Heat transfer rate and film cooling effectiveness measurements in a transient cascade N81-13000

P

PACIFIC MISSILE RANGE, POINT MUGU, CALIF.

Summary of pacific missile test center meteorological support Air Quality Assessment Model (AQAM) tests at the Naval Air Station, Mirimar, 1 to 8 August 1979 [AD-A090529] N81-12650

PEAT, MARWICK, MITCHELL AND CO., SAN FRANCISCO, CALIF.

Aircraft towing feasibility study [DOE/CS-50069/1] N81-12051

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.

Applications of HCMM satellite data to the study of urban heating patterns [E81-10025] N81-12502

Controlled cadmium telluride thin films for solar cell applications, emerging materials systems for solar cell applications [DOE/ET-23013/T5] N81-12597

A global model of the neutral thermosphere in magnetic coordinates based on AE-C data [NASA-CR-163796] N81-12684

Parametric acoustic conversion-efficiency enhancement via boundary induced and inherent dispersivity [AD-A090329] N81-12823

PHILIPS LABS., BRIARCLIFF MANOR, NEW YORK.

Development of an electrophoretic image display [AD-A090574] N81-12396

PHOENIX CORP., MCLEAN, VA.

Off-axis coherently pumped laser [NASA-CASE-GSC-12592-1] N81-12407

PIONEER ENGINEERING AND MFG. CO., INC., WARREN, MICH.

Vehicle systems design optimization study *[NASA-CR-163797]* N81-12944

POITIERS UNIV. (FRANCE).

The application of UV spectroscopy to the *qualitative analysis of nitrogen oxide* N81-13008

POLITECNICO DI MILANO (ITALY).

Droplet size measurements in combustion by the visibility method N81-13014

POLY SOLAR, INC., GARLAND, TEX.

Low cost thin film polycrystalline silicon solar cells [DOE/ET-23048/T1] N81-12603

POLYTECHNIC INST. OF NEW YORK.

Software test models and implementation of associated test drivers [AD-A089997] N81-12763

PRATT AND WHITNEY AIRCRAFT, WEST PALM BEACH, FLA.

Advanced industrial gas turbine techology readiness demonstration [DOE/OR-05035/T1] N81-12426

PRATT AND WHITNEY AIRCRAFT GROUP, EAST HARTFORD, CONN.

Rotor redesign for a highly loaded 1800 ft/sec tip speed fan, 2 [NASA-CR-159879] N81-12087

Design of a multivariable integrated control for a supersonic propulsion system N81-12094

Propulsion controls N81-12095

Problem in the measurement of metal temperature, gas temperature, heat flux and strain in combustors *and turbines* N81-12994

PRB-RECTICEL, WETTEREN (BELGIUM).

Development of a new polyurea foam insulation *material* [EUR-6737-EN] N81-12235

PRINCETON UNIV., N. J.

Maxwell-Vlasov equations as a continuous Hamiltonian system [PPPL-1702] N81-12797

Toroidal plasma equilibrium with gravity [PPPL-1704] N81-12895

PROPELLANTS, EXPLOSIVES AND ROCKET MOTOR ESTABLISHMENT, WESTCOTT (ENGLAND).

Production of nitrous oxide in a rocket motor exhaust [PERME-MEMO-96] N81-12167

The use of an arc image furnance for solid propellant ignition studies. An undergraduate student report [PERME-MEMO-111] N81-12282

PUBLIC SERVICE CO. OF OKLAHOMA, TULSA.

Solar repowering for electric generation. *Northeastern Station Unit 1, Public Service Company* of Oklahoma [DOE/SF-10738/1-3] N81-12598

Solar repowering for electric generation. Northeastern Station Unit 1, Public Service Company of Oklahoma [DOE/SF-10738-1/2] N81-12600

PURDUE UNIV., FORT WAYNE, IND.

Solar cell utilizing photochemical generation of electricity [DOE/R5-10114/1] N81-12581

PURDUE UNIV., LAFAYETTE, IND.

Multivariable nyquest array method with application to turbofan engine control N81-12101

Contact law and impact responses of laminated composites [NASA-CR-159884] N81-12172

Forest resource information system [E81-10004] N81-12481

Effects of management practices on reflectance of spring wheat canopies [E81-10019] N81-12496

An assessment of LANDSAT data acquisition history on identification and area estimation of corn and soybeans [E81-10027] N81-12504

Contextual classification of multispectral image data: Approximate algorithm [E81-10038] N81-12520

Interdigitated back contact solar cells [SAND-80-7104] N81-12607

R

RADEX, INC., CARLISLE, MASS.

Analysis of spacecraft charging and geophysical data bases [AD-A090020] N81-12141

RADIO CORP. OF AMERICA, VAN NUYS, CALIF.

Design, development, fabrication and delivery of register and multiplexer units *[NASA-CR-150801]* N81-12746

RAYTHEON CO., WAYLAND, MASS.

Development of CO2 laser Doppler instrumentation *for detection of clear air turbulence, volume 1* [NASA-CR-161611] N81-12697

Development of CO2 laser Doppler instrumentation *for detection of clear air turbulence, volume 2:* Appendices [NASA-CR-161610] N81-12698

RAYTHEON SERVICE CO., ARLINGTON, VA.

Wind energy systems: Program summary [DOE/CS-20097/01] N81-12580

RCA ADVANCED TECHNOLOGY LABS., CAMDEN, N. J.

High speed CMOS/SOS standard cell notebook [NASA-CR-150783] N81-12323

C-MOS array design techniques [NASA-CR-150799] N81-12328

RCA LABS., PRINCETON, N. J.

Photovoltaic mechanisms in polycrystalline thin-film silicon solar cells [DOE/ET-23108/4] N81-12601

Passivation of GaAs surfaces [AD-A090512] N81-12909

RENSSELAER POLYTECHNIC INST., TROY, N. Y.

The decomposition of N2O on Ni (110) [AD-A090552] N81-12193

Preliminary study on the potential usefulness of array *processor techniques for structural synthesis* [NASA-CR-163801] N81-12447

RESEARCH INST. FOR ENVIRONMENTAL HYGIENE, *TNO, DELFT (NETHERLANDS).*

Measuring particulate air pollution [IG-PUBL-638] N81-12664

RHODE ISLAND UNIV., KINGSTON.

Applications of efficient subset selection to digital filtering and to signal resolution [AD-A090128] N81-12813

RICE UNIV., HOUSTON, TEX.

Solar power satellite offshore rectenna study [NASA-CR-3348] N81-12558

ROCHESTER UNIV., N. Y.

An analysis of the various methods used to analyze radiation from the thin wire E field integral equation [AD-A090488] N81-12307

Effect of ionizing radiations on connective tissue [UR-3490-1900] N81-12732

Studies of heavy ion reactions and transuranic nuclei [COO-3496-75] N81-12841

ROCKEFELLER UNIV., NEW YORK.

Diffractive hadron dissociation at 100 and 200 GeV [DOE/ER-02232/89] N81-12837

ROCKWELL INTERNATIONAL CORP., ANAHEIM, CALIF.

Room temperature, CW, single mode laser [AD-A090326] N81-12410

Advanced IR imaging seeker program [AD-A090642] N81-12869

ROCKWELL INTERNATIONAL CORP., COLUMBUS, OHIO.

Satellite Power System (SPS) laser studies. Volume 2: Meteorological effects on laser beam propagation and direct solar pumped lasers for the SPS [NASA-CR-3347] N81-12560

ROCKWELL INTERNATIONAL CORP., SEAL BEACH, CALIF.

Background motion effects on staring sensors and the relative effectiveness of signal processing filters in minimizing such effects on target detection [AD-A090644] N81-12146

ROCKWELL INTERNATIONAL CORP., THOUSAND OAKS, CALIF.

Studies of the mechanisms of coal hydrogenation by electron spin resonance [DOE/PC-30072/T1] N81-12272

Research in multi-color thin film emitters [AD-A090472] N81-12908

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, FORT COLLINS, COLO.
A digital systematic classification of ecosystems with an illustrated summary of the natural vegetation of North America
[PB80-194020] N81-12532

ROHR INDUSTRIES, INC., CHULA VISTA, CALIF.
Sonic fatigue design techniques for advanced *composites aircraft structures*
[AD-A090553] N81-12069

ROLLS-ROYCE LTD., BRISTOL (ENGLAND).
An attempt to *minimize secondary flow effects in a* turbine
[PNR-90020] N81-12083
Metallurgical aspects of *materials processing and* manufacturing for aero-engine components
[PNR-90019] N81-12209

ROLLS-ROYCE LTD., DERBY (ENGLAND).
System to measure the pressure distribution on fan aerofoil surfaces during flutter conditions
[PNR-90013] N81-12029
The design development and operation of gas turbine radio telemetry systems
[EIR-00733] N81-12082
The use of resin systems in the modern aerospace foundry
[PNR-90014] N81-12170
The development of the composite material engine nacelle
[AAAF-NT-79-38] N81-12180
Shear layer instability noise produced by various jet nozzle configurations
[PNR-90018] N81-12825

ROM-AIRE SOLAR CORP., AVON LAKE, OHIO.
Low cost, bare plate solar air collector
[DOE/R5-10143/1] N81-12605

ROYAL AIRCRAFT ESTABLISHMENT, BEDFORD (ENGLAND).
The flying qualities of aircraft with actively augmented *pitch and yaw stability*
[ARC-R/M-3848] N81-12113

ROYAL AIRCRAFT ESTABLISHMENT, FARNBOROUGH (ENGLAND).
The Reynolds number for transition on a flat plate in the RAE 4 ft x 3 ft low turbulence wind tunnel
[RAE-TM-AERO-1854] N81-12037
The prediction of the bursting of laminar separation bubbles in the design of two dimensional high-lift aerofoils
[RAE-TR-80060] N81-12038
Lumped harmonics of 15th and 30th order in the geopotential from the resonant orbit of 1971-54A
[RAE-TR-80088] N81-12132
Solar power satellites. A review of the space transportation options
[RAE-TR-80034] N81-12153
Evaluation of woven fabrics based on Graphil XAS 3000-filament carbon fibre
[RAE-TM-MAT-339] N81-12248
The intelligibility of speech presented over the telephones of the Mk 4 flying helmet
[RAE-TM-FS-313] N81-12320
Mobility measurements on a beam and a dynamic absorber
[RAE-TM-AERO-1842] N81-12468
Green's function in fracture mechanics
[RAE-TR-80035] N81-12469
The normal modes of beam-like structures by a Lanczos-Stodola method
[RAE-TR-80058] N81-12470
A cartographic computer data format and associated programs
[RAE-TR-80037] N81-12539
Features of the upper atmosphere revealed by analysis of the orbit of Cosmos 1009 rocket, 1978-50B
[RAE-TR-80052] N81-12693
Some further thoughts on temporary threshold shift
[RAE-TM-FS-338] N81-12734
The recording and preliminary analysis of a data base for the assessment of strain in air traffic controllers, using speech
[RAE-TM-FS-334] N81-12737
Noise measurements and the dB
[RAE-TM-FS-348] N81-12827
A scientific data base for the Royal Aircraft Establishment, Farnborough, England
[RAE-TR-80048] N81-12832

ROYAL NETHERLANDS AIRCRAFT FACTORIES FOKKER, SCHIPHOL-OOST.
Mechanical properties of Kevlar reinforced Redux 312 L adhesive joints
[FOK-R-2369] N81-12249
Acoustic emission of carbon fiber reinforced plastics
[FOK-R-2464] N81-12250
Test report of the proof pressure and leak tests, performed on the Viewport Adaptor Assembly
[FOK-RV-79-24] N81-12444
Investigation of minimum characteristic length of an area of solar cells loaded by a sound field
[FOK-RV-79-18] N81-12471

ROYAL NETHERLANDS METEOROLOGICAL INST., THE HAGUE.
A set of computer programs to process turbulence data measured at the 200 m mast at Cabauw, *Netherlands*
[KNMI-WR-80-3] N81-12706

ROYAL SIGNALS AND RADAR ESTABLISHMENT, MALVERN (ENGLAND).
Developments in United Kingdom waveguide power standards
[RSRE-80006] N81-12319
A comparison between electric field strengths similarly generated and measured in the open air, in *a shielded enclosure and in a large aircraft hangar,* over frequency range 10 to 110 MHz
[RSRE-MEMO-3248] N81-12353
Graph theory leads to program visibility
[RSRE-80004] N81-12771
POSER: A Process Organization to Simplify Error *Recovery*
[RSRE-MEMO-3249] N81-12772
An overview of reliable computer system design
[RSRE-80003] N81-12775

S

SAAB-SCANIA, GOTEBERG (SWEDEN).
Multigrid technique applied to lifting transonic flow *using full potential equation*
[SAAB-L-0-1-B439] N81-12028
Buckling of sandwich panels subjected to axial compression, shear forces and lateral pressure. Part 2: Analysis
[SAAB-TN-AE-72-PT-2] N81-12465
Some aspects on improvements of a first-order dynamic optimization algorithm
[SAAB-TN-AE-73] N81-12769

SAAB-SCANIA, LINKOPING (SWEDEN).
On the decision to replace a unit early or late: A graphical solution
[SAAB-FTK-0-79-19] N81-12438
On a general asymptotic independence: Result in statistics, a preliminary report
[SAAB-FTK-0-79-22] N81-12804

SANDIA LABS., ALBUQUERQUE, N. MEX.
Morphology and phase composition of an amine cured rubber modified epoxy
[SAND-80-1914C] N81-12242
Development and testing of polymer reflectors
[SAND-80-1483C] N81-12243
Stability and compatibility studies with the inorganic explosive 2-(5-cyanotetrazolato) pentaaminecobalt (3) perchlorate (cp)
[SAND-80-0965C] N81-12276
Improved recursive formula for calculating shock response spectra
[SAND-80-1315C] N81-12367
Portable instrumentation for solar absorptance and emittance measurements
[SAND-80-1541C] N81-12401
Development of a second generation portable specular reflectometer
[SAND-80-1509C] N81-12402
Solar total energy modularity study
[SAND-80-7060] N81-12608
Black chrome solar selective coating
[SAND-80-1480C] N81-12623
Some singular integral equations in linear transport theory
[SAND-80-1069] N81-12795
CDC 6600/7600 subroutine for bessel functions Y/sub nx x 0, nu or = 0
[SAND-80-1498] N81-12796

SANDIA LABS., LIVERMORE, CALIF.
Applications of optical diagnostic techniques in *combustion research* N81-13013

SCIENCE APPLICATIONS, INC., BOULDER, COLO.
Trapped electron modifications to tearing modes in *the low collision frequency limit*
[SAI-245-80-348-LJ] N81-12846
Strongly-localized ballooning modes in a tandem *mirror*
[SAI-254-80-493-LJ] N81-12890
Collisional end losses from conventional and tandem *mirrors*
[SAI-254-80-442-LJ] N81-12892
Lower-hybrid-drift instability with axis encircling *ions*
[SAI-254-80-477-LJ] N81-12893
Bumpy torus transport in the low collision frequency *limit*
[SAI-254-80-347-LJ] N81-12894

SCIENCE APPLICATIONS, INC., CANOGA PARK, CALIF.
Mixing and combustion in high speed air flows
[AD-A090536] N81-12192

SCIENCE APPLICATIONS, INC., LA JOLLA, CALIF.
Gas release and conductivity modification studies
[NASA-CR-160047] N81-12883

SCIENTIFIC TRANSLATION SERVICE, ANN ARBOR, MICH.
Influence of ultrasonic vibration on short-range order in alpha-aluminum bronzes
[ANL-TRANS-1190] N81-12212

SHEFFIELD UNIV. (ENGLAND).
Research in progress: Antennas, Propagation and *Digital Image Processing Group (APDIP)*
N81-12317

SIEMENS A.G., ERLANGEN (WEST GERMANY).
Space-charges in polymers
[BMFT-FB-T-80-036] N81-12236

SIEMENS A.G., MUNICH (WEST GERMANY).
Physical and chemical processes for the generation of one micrometer structures
[BMFT-FB-T-79-51] N81-12291
Large scale integrated MOS circuits with small dimensions. Preparation of thin films
[BMFT-FB-T-79-55] N81-12346
Circuit design techniques for MOS memories
[BMFT-FB-DV-79-07] N81-12347
Fault diagnosis system for complex logic board
[BMFT-FB-DV-79-10] N81-12348
Homogeneous phosphorus doping of silicon by neutron transmutation
[BMFT-FB-T-79-52] N81-12925

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.
Adaptive HF propagation path utilization
[AD-A090023] N81-12301
Test and evaluation of water vapor radiometers
[NASA-CR-160043] N81-12391

SOCIETE CROUZET, VALENCE (FRANCE).
Development of hybrid circuits, a summary
[ESA-CR(P)-1243-REV-B] N81-12350

SOCIETE EUROPEENNE DE PROPULSION, VERNON (FRANCE).
Field emission electric propulsion. Development and manufacturing of a positive pressure tank
[ESA-CR(P)-1365] N81-12165

SOCIETE FRANCAISE D'ETUDES ET DE REALISATIONS D'EQUIPMENTS AERONAUTIQUES (SOFREAVIA), PARIS (FRANCE).
Study of the operational deployment of SIRIO-2 ground stations. Volume 1
[ESA-CR(P)-1369-VOL-1] N81-12711
Study of the operational deployment of SIRIO-2 ground stations. Volume 2
[ESA-CR(P)-1369-VOL-2] N81-12712
Study of the operational deployment of SIRIO-2 ground stations, volume 3
[ESA-CR(P)-1369-VOL-3] N81-12713

SOCIETE NATIONALE D'ETUDES ET DE CONSTRUCTION DE MOTEURS D'AVIATION, MOISSY-CRAMAYEL (FRANCE).
Studying the exhaust gas from a post combustion turbojet engine N81-12996

SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, CANNES (FRANCE).
Development of a fold-out rigid solar array for three axis-stabilized geosynchronous satellites
[SNIAS-801-440-101] N81-12150

SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, LES MUREAUX (FRANCE).
Use of ultra-light adhesive for metal honeycomb bonding
[SNIAS-801-422-104] N81-12247
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, MARIGNANE (FRANCE.)
Impact of modern materials on the development of rotating airfoil equipment
[AAAF-NT-79-43] N81-12182
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, SURESNES (FRANCE).
Tests on the fire resistance behavior of materials inside civil aircraft
[SNIAS-801-551-101] N81-12052
Effect of various surface protections on the stress corrosion behavior of light alloys
[SNIAS-801-551-102] N81-12220
Use of superplastic forming techniques to fabricate titanium alloy (T-A6V) tanks
[SNIAS-801-551-103] N81-12221
Experimental methodology. Application of concepts from mechanics to material rupture studies
[SNIAS-801-551-104] N81-12466
SOCIETE NATIONALE INDUSTRIELLE AEROSPATIALE, TOULOUSE (FRANCE).
Synthesis of test results obtained with Concorde at high incidences
[AAAF-NT-80-26] N81-12079
SOLAREX CORP., ROCKVILLE, MD.
Phase 2 of the array automated assembly task for the low cost silicon solar array project
[NASA-CR-163805] N81-12552
SOUTH DAKOTA STATE UNIV., BROOKINGS.
Remote sensing applications to resource problems in South Dakota
[E81-10029] N81-12511
SOUTHERN METHODIST UNIV., DALLAS, TEX.
Investigation of blown boundary layers with an improved wall jet system
[NASA-CR-3340] N81-12360
Measurements of unsteady turbulent boundary layers with pressure gradients
[AD-A090585] N81-12366
SOUTHWEST RESEARCH INST., SAN ANTONIO, TEX.
Nondestructive testing information analysis center, 1979
[AD-A090718] N81-12442
Fatigue microcrack behavior under the influence of surface residual stresses
[AD-A090561] N81-12452
Coal thickness guage using RRAS techniques, parts 2 and 3
[NASA-CR-161607] N81-12524
SPERRY FLIGHT SYSTEMS, PHOENIX, ARIZ.
Design of the Annular Suspension and Pointing System (ASPS) (including design addendum)
[NASA-CR-3343] N81-12158
SPERRY UNIVAC, ST. PAUL, MINN.
Investigation of multilayer magnetic domain lattice file
[NASA-CR-159324] N81-12745
SRI INTERNATIONAL CORP., MENLO PARK, CALIF.
Airport and airspace delay model description
[AD-A090781] N81-12049
A study of knowledge-based systems for photo interpretation
[AD-A090465] N81-12530
On the suitability of ADA for artificial intelligence applications
[AD-A090790] N81-12777
STANFORD UNIV., CALIF.
The compilation of regular expressions into integrated circuits
[AD-A090507] N81-12334
Geological and geothermal data use investigations for Application Explorer Mission-A (Heat Capacity Mapping Mission)
[E81-10018] N81-12495
STATE UNIV. COLL. OF NEW YORK AT ONEONTA.
Evaluation of three techniques for classifying urban land cover patterns using LANDSAT MSS data
[E81-10007] N81-12484
STD RESEARCH CORP., ARCADIA, CALIF.
Analytical investigation of critical phenomena in MHD power generators
[NASA-CR-165143] N81-12546
STICHTING MATHEMATISCH CENTRUM, AMSTERDAM (NETHERLANDS).
A natural data type with a finite equational final semantics specification but no effective equational initial semantics specification
[MC-IW-133/80] N81-12799
A note on two integrals related with Bessel functions
[MC-TW-199/80] N81-12800
Clines in the presence of asymmetric migration
[MC-TW-200/80] N81-12811
STUTTGART UNIV. (WEST GERMANY).
Static and dynamic investigations using a windmill model
[ISD-259] N81-12626
Load cycle values and materials data used for the description of a wind turbine featuring a special hub construction
[ISD-260] N81-12627
Static and dynamic investigations on different towers for wind turbines
[ISD-261] N81-12628
Wave propagation in a temperate plasma having n ions species
[IPF-78-7] N81-12899
Absorption of magnetoacoustic waves in a high beta plasma
[IPF-79-3] N81-12900
SUSSEX UNIV., BRIGHTON (ENGLAND).
Studies of turbulence characteristics and their effects upon the distribution of heat transfer to turbine blading N81-13001
The use of optical techniques in the interpretation of heat transfer measurements N81-13007
SWEDISH BOARD FOR SPACE ACTIVITIES, SOLNA.
Swedish space activities during 1979 N81-12125
SYRACUSE UNIV., N. Y.
A special-purpose processor for an automatic feature extraction system
[AD-A090789] N81-12765
SYSTEM DEVELOPMENT CORP., SANTA MONICA, CALIF.
Testing of composite structures
[AAAF-NT-79-41] N81-12181
SYSTEMS DESIGNERS LTD., CAMBERLEY (ENGLAND).
Reliable software: Standards for the production of high quality systems
[ESA-CR(P)-1358] N81-12770
SYSTEMS SCIENCE AND SOFTWARE, LA JOLLA, CALIF.
Numerical modeling of inlet manifold flows in internal combustion engines
[SSS-R-80-4620] N81-12428
SYSTEMS TECHNOLOGY, INC., HAWTHORNE, CALIF.
Practical optimal flight control system design for helicopter aircraft. Volume 2: Software user's guide
[NASA-CR-152306] N81-12110

T

TECHNISCHE HOGESCHOOL, DELFT (NETHERLANDS).
Station control and the orbit of Skylab during the period April 1978 to July 1979
[VTH-LR-288] N81-12131
The constant volume process in relation to the gas turbine as exemplified by the Karavodine engine
[WTHD-118] N81-12434
TECHNISCHE UNIV., BERLIN (WEST GERMANY).
Automatic construction of semantic networks
[BMFT-FB-ID-79-05] N81-12781
TEL-AVIV UNIV. (ISRAEL).
A unified theory of magnetic Bremsstrahlung, electrostatic Bremsstrahlung, Compton-Raman scattering and Cerenkov-Smith-Purcell free electron lasers
[AD-A090559] N81-12416
TENNESSEE UNIV., KNOXVILLE.
Vacuum ultraviolet electronic properties of liquids
[DOE/EV-03861/T1] N81-12200
Equivalent Gaussian measures whose R-N derivative is the exponential of a diagonal form
[AD-A090787] N81-12807
Multiple ionization and excitation processes in single ion-atom collisions
[CONF-800859-1] N81-12838
TENNESSEE VALLEY AUTHORITY, CHATTANOOGA.
Trophic classification of Tennessee Valley area reservoirs derived from LANDSAT multispectral scanner data
[E81-10008] N81-12485
TEXAS A&M UNIV., COLLEGE STATION.
Bent crystal X-ray topography
[NASA-CR-150884] N81-12942
TEXAS TECHNOLOGICAL UNIV., LUBBOCK.
Numerical analysis of the flow in the connecting passage between the fan section and high pressure section of a turbojet engine
[AD-A090506] N81-12107
TEXAS UNIV. AT AUSTIN.
An integrated methodology and tools for software development
[AD-A090347] N81-12766
THERMAL SYSTEMS ENGINEERING, INC., WOBURN, MASS.
Heat recovery devices, new
[PB80-205438] N81-12384
THOMSON-CSF, PARIS (FRANCE).
Phase A study of SAR for the European remote sensing programme: Additional studies. Executive summary
[ESA-CR(P)-1375] N81-12537
TOLEDO UNIV., OHIO.
Sensor/actuator failure detection for turbofan engines N81-12104
TRW DEFENSE AND SPACE SYSTEMS GROUP, REDONDO BEACH, CALIF.
Mission integration study for solid Teflon pulsed plasma millipound propulsion system
[AD-A090514] N81-12162
Materials processing in space: Future technology trends N81-12991

U

UELAND AND JUNKER, ARCHITECTS AND PLANNERS, PHILADELPHIA, PA.
Solar atrium: A hybrid solar heating and cooling system
[DOE/EG-34135/10] N81-12585
UNILEVER RESEARCH, VLAARDINGEN (NETHERLANDS).
A check panel for the MSE analytical ultracentrifuge N81-12404
UNION CARBIDE CORP., TONAWANDA, N.Y.
Insulation development for high-temperature batteries for electric vehicle application
[CONS-5160-T1] N81-12571
UNITED TECHNOLOGIES CORP., EAST HARTFORD, CONN.
Experimental study of the stability of aircraft fuels at elevated temperatures
[NASA-CR-165165] N81-12255
UNITED TECHNOLOGIES RESEARCH CENTER, EAST HARTFORD, CONN.
Investigations of Coherent Anti-Stokes Raman Spectroscopy (CARS) for practical combustion diagnostics N81-13010
UNIVERSITE DES SCIENCES ET TECHNIQUES DE LILLE (FRANCE).
Experimental and numerical study of flow in air intakes at high incidences
[AAAF-NT-80-19] N81-12031
Influence of light aircraft architecture on its spin characteristics
[AAAF-NT-80-11] N81-12111
Some new research approaches to aircraft spin studies
[AAAF-NT-80-12] N81-12112
UNIVERSITY OF SOUTHEASTERN MASSACHUSETTS, NORTH DARTMOUTH.
Overlapped subarraying techniques
[AD-A089693] N81-12304
Geothermal energy as a source of electricity. A worldwide survey of the design and operation of geothermal power plants
[DOE/RA-28320/1] N81-12579
Two experiments on statistical image segmentation
[AD-A089484] N81-12764
UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES.
Excimer potential curves
[AD-A090516] N81-12414

Carbon dioxide for the recovery of crude oil
[DOE/SF-0113/4] N81-12533

UNIVERSITY OF WESTERN MICHIGAN, KALAMAZOO.
Fundamentals of nitric oxide formation in fossil fuel combustion
[FE-2018-17] N81-12197

UTAH UNIV., SALT LAKE CITY.
Brillouin scattering studies of the effect of orientation on the mechanically deformed poly-(ethylene terepthalate)
[AD-A090589] N81-12866

V

VANDERBILT UNIV., NASHVILLE, TENN.
CAMIRD 3: Computer Assisted Medical Internal Radiation Dosimetry, FORTRAN IV version
[DOE/EV-10303/5] N81-12731

VERMONT UNIV., BURLINGTON.
Remote sensing program activity report
[E81-10015] N81-12492
Magnetic properties and moessbauer spectra of several iron (3) dicarboxylic acid complexes
[AD-A090705] N81-12911
A study of magnetic and spectroscopic properties of Fe(II)Fe(III)2O(CH3CO2)6L3, L=H2O or C5H5N. Direct observation of the thermal barrier to electron transfer in a mixed valence complex
[AD-A090706] N81-12912

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG.
Engine identification for adaptive control
N81-12100

VIRGINIA UNIV., CHARLOTTESVILLE.
Geological and hydrochemical sensitivity of the eastern United States to acid precipitation
[BNL-51189] N81-12663

VON KARMAN INST. FOR FLUID DYNAMICS, RHODE-SAINT-GENESE (BELGIUM).
Principle of laser Doppler velocimeter measurements in a fully transparent pump
[VKI-PREPRINT-1979-12] N81-12375
A heat transfer prediction method for turbulent boundary layers developing over rough surfaces with transpiration
[VKI-PREPRINT-1979-13] N81-12376
Turbulent mixing and concentration measurement
[VKI-PREPRINT-1980-8] N81-12377
Simultaneous two dimensional measurements with one color laser Doppler velocimeter
[VKI-TM-28] N81-12383
Reverse flow, pre-rotation and unsteady inlet flow in centrifugal pumps
[VKI-PREPRINT-1979-15] N81-12433
Measurement of the solar radiative properties of silica gel
[VKI-TM-29] N81-12635
Heat transfer measurements related to hot turbine components in the von Karman institute hot cascade tunnel N81-12999
Velocity measurement techniques in liquid sprays using laser Doppler velocimetry N81-13004
A method for the measurements of mixing properties in a flow N81-13015

VOUGHT CORP. ADVANCED TECHNOLOGY CENTER, INC., DALLAS, TEX.
Low drag airfoil design utilizing passive laminar flow and coupled diffusion control techniques
[AD-A090778] N81-12024
Turbulence modeling for application to V/STOL propulsion induced effects: Two dimensional formulation
[AD-A090331] N81-12026

W

WALTER REED ARMY INST. OF RESEARCH, WASHINGTON, D.C.
Rapid transmeridian deployment: Cognitive performance and chronobiologic prophylaxis for circadian dyschronism
[AD-A090393] N81-12727

WASHINGTON UNIV., SEATTLE.
A reinvestigation of transients in the cyclopropane system by the variable encounter method
[AD-A090168] N81-12226
On developing a theory of distributed computing summary of current research
[AD-A090773] N81-12750
Optimal resource placement in a distributed system (extended abstract)
[AD-A090772] N81-12780
Decidability and expressiveness of logics of processes
[AD-A090688] N81-12788

WASHINGTON UNIV., ST. LOUIS, MO.
Epitaxial growth of CdSnP2 on InP for microwave FETs
[AD-A090285] N81-12913

WESTINGHOUSE ELECTRIC CORP., MERCURY, NEV.
Spent fuel handling and packaging program
[DOE/NV-10061/3] N81-12851

WESTINGHOUSE ELECTRIC CORP., PITTSBURGH, PA.
Parametric infrared tunable laser system
[NASA-CR-159310] N81-12405

WHITE SANDS MISSILE RANGE, N.MEX.
Experimentally determined relationship between extinction and liquid water content
[AD-A090368] N81-12411

WISCONSIN UNIV., MADISON.
For multidisciplinary research on the application of remote sensing to water resources problems
[E81-10017] N81-12494
Definition of problems of persons in sheltered care environments
[NASA-CR-160050] N81-12725
Stability analysis of cylindrical Vlasov equilibria
[COO-2387-113] N81-12897

WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).
Technical regulations: Hydrology and international hydrological codes
[WMO-555] N81-12540
Meteorological factors affecting the epidemiology of the cotton leaf worm and the pink bollworm
[WMO-532] N81-12707
Report of the first session of the Joint Scientific Committee for the World Climate Research Program and the Global Atmospheric Research Program
N81-12708
First Global Atmospheric Research Programme (GARP) Global experiment operations report series. Volume 7: Winter MONEX field phase report
N81-12709
The Global Weather Experiment. First Global Atmospheric Research Programme (GARP) global experiment operations report series. Volume 9: Results of summer MONEX field phase research, part A N81-12710
Manual on the global data processing system. Volume 2: Regional aspects
[WMO-485-VOL-2] N81-12714

WYLE LABS., INC., EL SEGUNDO, CALIF.
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 1: Methods, procedures, results
[EPA-550/9-79-313-1] N81-12644
Noise exposure of civil aircarrier airplanes through the year 2000. Volume 2: Appendices A through F
[EPA-550/9-70-313-2] N81-12645

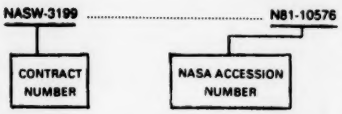
X

XEROX PALO ALTO RESEARCH CENTER, CALIF.
Dynamic properties of electronic trapping centers at the SiSiO2 interface
[AD-A090584] N81-12910

Y

YALE UNIV., NEW HAVEN, CONN.
Energies of organic compounds
[DOE/ER-04060/T1] N81-12168

Typical Contract Number Index Listing



Listings in this index are arranged alphanumerically by contract number. Under each contract number the NASA accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order. The NASA accession number denotes the number by which the citation is identified.

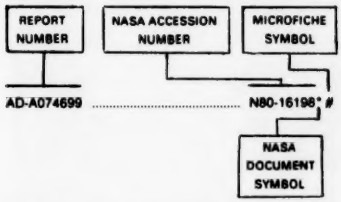
DE-AS02-76ET-28320 ..... N81-12579
AF PROJ. 317J N81-12365
AF PROJ. 670B N81-12056
AF PROJ. 1900 ..... N81-12651
N81-12653
AF PROJ. 2103 ..... N81-12652
AF PROJ. 2301 ..... N81-12303
N81-12416
N81-12831
AF PROJ. 2304 ..... N81-12025
N81-12300
N81-12728
N81-12763
N81-12778
N81-12779
N81-12805
N81-12806
N81-12813
N81-12814
AF PROJ. 2305 ..... N81-12304
N81-12397
N81-12765
N81-12909
AF PROJ. 2307 ..... N81-12107
N81-12108
N81-12440
N81-12450
N81-12451
N81-12458
AF PROJ. 2308 ..... N81-12192
N81-12262
AF PROJ. 2309 ..... N81-12907
AF PROJ. 2313 ..... N81-12726
AF PROJ. 2338 ..... N81-12338
AF PROJ. 2402 ..... N81-12050
AF PROJ. 3058 ..... N81-12162
AF PROJ. 3221 ..... N81-12143
AF PROJ. 4506 ..... N81-12340
AF PROJ. 4594 ..... N81-12790
AF PROJ. 4643 ..... N81-12301
AF PROJ. 6670 ..... N81-12130
AF PROJ. 6687 ..... N81-12364
AF PROJ. 6690 ..... N81-12685
AF PROJ. 7351 ..... N81-12453
AF PROJ. 7661 ..... N81-12147
N81-12148
AF PROJ. 9993 ..... N81-12141
AF-AFOSR-0035-79 ..... N81-12303
AF-AFOSR-0070-80 ..... N81-12765
AF-AFOSR-0073-80 ..... N81-12416
AF-AFOSR-0112-79 ..... N81-12304
AF-AFOSR-3063-76 ..... N81-12805
AF-AFOSR-3092-76 ..... N81-12728
N81-12778
N81-12814
AF-AFOSR-3174-77 ..... N81-12813
AF-AFOSR-3236-77 ..... N81-12779
AF-AFOSR-3336-77 ..... N81-12262
AF-AFOSR-3409-77 ..... N81-12766
AF-AFOSR-3524-78 ..... N81-12025
AF-AFOSR-3561-78 ..... N81-12107
AFOSR MIPR-GY1175-79-N-2119 ..... N81-12306
ARPA ORDER 2894 ..... N81-12777
ARPA ORDER 3341 ..... N81-12768
ARPA ORDER 3718 ..... N81-12339
AT/2037/084 ..... N81-12378
BMFT-ET-4086-A N81-12627
BMFT-ET-4086A N81-12626
N81-12628
B232-76-1B108 ..... N81-12732
CNR-73-01435 ..... N81-12419
CNR-74-00831.11 ..... N81-12901
CNR-78-00901.02 ..... N81-12371
DA PROJ. 1L1-61101-A-91A N81-12335
DA PROJ. 1L1-61102-AH-42 ..... N81-12229
DA PROJ. 1L1-61102-AH-43 ..... N81-12142
DA PROJ. 1L1-61102-AH-47 ..... N81-12568
DA PROJ. 1L1-62209-AH-76 ..... N81-12075
DA PROJ. 1L1-62618-AH-80 ..... N81-12480
DA PROJ. 1L1-62705-AH-94 ..... N81-12302
DA PROJ. 1T1-61101-A-91A N81-12425
DA PROJ. 3E1-62773-A-819 ..... N81-12730
N81-12740
DA PROJ. 4A1-61102-AT-24 ..... N81-12424
DAAD05-77-C-0722 ..... N81-12787
DAAG29-76-G-0187 ..... N81-12366
DAAG29-77-G-0021 ..... N81-12308
DAAG29-77-G-0075 ..... N81-12310
DAAG29-77-G-0091 ..... N81-12233
DAAG29-79-C-0116 ..... N81-12910
DAAG29-79-C-0121 ..... N81-12190
DAAG29-79-C-0155 ..... N81-12780
DAAG29-79-C-0161 ..... N81-12728
DAAG29-79-C-0216 ..... N81-12777
DAAG46-79-C-0004 ..... N81-12229
DAAG46-79-C-0049 ..... N81-12454
N81-12455
DAAG49-79-C-0009 ..... N81-12176
DAAJ02-76-C-0045 ..... N81-12075
DAAK10-78-C-0029 ..... N81-12260
DAAK20-79-C-0251 ..... N81-12302
DAAK40-77-C-0129 ..... N81-12869
DAAK70-77-C-0214 ..... N81-12423
DAAK70-78-C-0114 ..... N81-12530
DARPA ORDER 3239 ..... N81-12869
DARPA ORDER 3802 ..... N81-12396
DE-AC01-76ET-10593 ..... N81-12197
DE-AC01-77IR-06065 ..... N81-12582
DE-AC01-78ET-20097 ..... N81-12580
DE-AC01-79CS-30118 ..... N81-12596
DE-AC01-79CS-50069 ..... N81-12051
DE-AC01-79ER-10062 ..... N81-12271
DE-AC01-79ET-14881 ..... N81-12273
DE-AC01-79ET-23108 ..... N81-12601
DE-AC01-79ET-27224 ..... N81-12658
DE-AC01-79EV-10291 ..... N81-12274
DE-AC01-79RG-10075 ..... N81-12269
DE-AC02-76CH-00016 ..... N81-12203
N81-12237
N81-12277
N81-12278
N81-12399
N81-12594
N81-12595
N81-12612
N81-12661
N81-12663
N81-12722
N81-12836
N81-12844
N81-12852
N81-12860
DE-AC02-76CH-00178 ..... N81-12196
N81-12573
DE-AC02-76CH-03000 ..... N81-12843
DE-AC02-76ER-01198 ..... N81-12916
DE-AC02-76ER-02232 ..... N81-12637
N81-12840
DE-AC02-76EV-03490 ..... N81-12732
DE-AC02-77CH-00178 ..... N81-12572
N81-12575
N81-12576
N81-12578
N81-12586
N81-12602
N81-12616
N81-12952
DE-AC02-77CS-34412 ..... N81-12584
DE-AC02-78CS-54894 ..... N81-12267
DE-AC02-79ER-10364 ..... N81-12853
DE-AC02-79ET-23013 ..... N81-12597
DE-AC02-80ER-10575 ..... N81-12874
DE-AC03-76-ET-53057 ..... N81-12846
DE-AC03-76ET-53057 ..... N81-12890
N81-12892
N81-12894
DE-AC03-79CS-40208 ..... N81-12195
DE-AC03-79ET-15303 ..... N81-12198
N81-12199
DE-AC03-79ET-23048 ..... N81-12603
DE-AC03-79ET-53057 ..... N81-12893
DE-AC03-79SF-10738 ..... N81-12598
N81-12600
DE-AC04-76CH-00016 ..... N81-12845
DE-AC04-76DA-00789 ..... N81-12243
DE-AC04-76DP-00613 ..... N81-12206
N81-12217
N81-12219
N81-12240
N81-12241
N81-12244
N81-12245
N81-12246
N81-12288
N81-12341
N81-12344
N81-12345
N81-12417
N81-12418
N81-12430
N81-12431
N81-12432
N81-12794
DE-AC04-76DP-00656 ..... N81-12238
N81-12239
DE-AC04-76DP-00789 ..... N81-12242
N81-12276
N81-12367
N81-12401
N81-12402
N81-12607
N81-12608
N81-12610
N81-12623
N81-12795
N81-12796
N81-13013
DE-AC04-79CS-31072 ..... N81-12215
DE-AC04-79DP-00613 ..... N81-12289
DE-AC04-80ET-15498 ..... N81-12428
DE-AC05-76ET-15343 ..... N81-12426
DE-AC05-76OR-00033 ..... N81-12920
DE-AC05-76OR-05035 ..... N81-12426
DE-AC06-76RL-01830 ..... N81-12609
N81-12704
N81-12733
DE-AC07-78ET-28455 ..... N81-12604
DE-AC08-80NV-10061 ..... N81-12851
DE-AC09-76SR-00001 ..... N81-12290

DE-AC22-79ET-14858 ..... N81-12266
DE-AC22-80PC-30072 ..... N81-12272
DE-AI01-76ET-12548 ..... N81-12523
DE-AI01-77DP-40042 ..... N81-12848
N81-12857
DE-AI01-78CS-4209 ..... N81-12943
DE-AI02-80CH-10048 ..... N81-12682
DE-AM02-76CH-03073 ..... N81-12797
N81-12895
DE-AM03-76SF-00113 ..... N81-12533
DE-AP01-79ET-21019 ..... N81-12599
DE-AS02-76ER-03496 ..... N81-12841
DE-AS02-76ER-04060 ..... N81-12168
DE-AS02-76EV-01340 ..... N81-12657
N81-12688
N81-12689
N81-12702
N81-12703
DE-AS02-77ER-04381 ..... N81-12873
DE-AS02-78ER-05002 ..... N81-12919
DE-AS02-78RA-04934 ..... N81-12611
DE-AS05-76ET-53045 ..... N81-12896
DE-AS05-76EV-03861 ..... N81-12200
DE-AS05-76EV-03941 ..... N81-12721
DE-AS05-80EV-10343 ..... N81-12731
DE-FC02-80CS-30377 ..... N81-12583
DE-FG02-77CS-34135 ..... N81-12585
DE-FG02-79RE-10143 ..... N81-12605
DE-FG02-79R5-10114 ..... N81-12581
DE-FG04-77CS-34136 ..... N81-12606
DEN3-179 ..... N81-12546
DLA900-79-C-1266 ..... N81-12442
DNA MIPR 80-563 ..... N81-12686
DOT-CG-42355-A N81-12189
DOT-FA77WA-4033 ..... N81-12049
DOT-FA79WAI-010 ..... N81-12047
EG-77-A-01-4090 ..... N81-12544
EG-77-C-01-4042 ..... N81-12586
EG-77-C-04-4121 ..... N81-12577
EG-77-G-04-4135 ..... N81-12585
EM-78-C-01-5157 ..... N81-12589
EM-78-C-01-5160 ..... N81-12571
EM-78-I-01-4209 ..... N81-12949
EN-76-C-02-2426 ..... N81-12265
EPA-IAG-D5-E681 ..... N81-12280
EPA-68-01-3514 ..... N81-12644
EPA-79-07-0681 ..... N81-12661
EPRI PROJ. 7850-1 ..... N81-12368
ESA-2839/76-HP N81-12350
ESA-3310/77-NL-AK(SC) N81-12754
ESA-3374/77-NL-AK N81-12165
ESA-3385 ..... N81-12770
ESA-3454/77 ..... N81-12159
ESA-3462/78-NL-AK(SC) N81-12752
ESA-3743/78-NL-PP(SC) N81-12128
ESA-3743/78/NL-PP(SC) N81-12129
ESA-3764/78-NL-PD N81-12472
ESA-3774/78/NL-PP N81-12381
ESA-3780/78-NL-HP(SC) N81-12163
ESA-4030/79-F/DD(SC) N81-12166
ESA-4041/79-F-FC(SC) N81-12160
ESA-4141/79-F-FC(SC) N81-12711
N81-12712
ESA-4226/80/F/CG(SC) N81-12537
ESTEC-2744/76-NL-AK(SC) N81-12164
ESTEC-3883/79-NL-HP(SC) N81-12420
ESTEC-3984/79-NL-AK(SC) N81-12380
ESTEC-4024/79-NL-AK(SC) N81-12379
EX-76-C-01-2375 ..... N81-12545
EX-77-R-01-6065 ..... N81-12582
EY-76-C-02-0092 ..... N81-12213
EY-76-C-02-2566 ..... N81-12950
EY-76-C-05-0033 ..... N81-12920
EY-76-C-06-1830 ..... N81-12704
EY-76-S-03-0113 ..... N81-12533
FMV-F-FL-82223-78-003-21-001 ..... N81-12223
F04611-78-C-0064 ..... N81-12162
F04701-76-C-0100 ..... N81-12441
F19628-76-C-0190 ..... N81-12685
F19628-79-C-0014 ..... N81-12141
F19628-79-C-0137 ..... N81-12301
F19628-79-C-0181 ..... N81-12397
F19628-80-C-0002 ..... N81-12056
N81-12143
N81-12790
F30602-78-C-0057 ..... N81-12763
F30602-78-C-0335 ..... N81-12338
F30602-79-C-0028 ..... N81-12340
F33615-75-C-1130 ..... N81-12191
F33615-76-C-5227 ..... N81-12453
F33615-77-C-3032 ..... N81-12458
F33615-77-C-3033 ..... N81-12069
F33615-78-C-3402 ..... N81-12050
F44620-76-C-0081 ..... N81-12440
F49620-77-C-0044 ..... N81-12192
F49620-77-C-0065 ..... N81-12907
F49620-78-C-0070 ..... N81-12108
F49620-78-C-0105 ..... N81-12451
F49620-79-C-0030 ..... N81-12726
F49620-79-C-0105 ..... N81-12806
F49620-79-C-0119 ..... N81-12300
F49620-79-C-0193 ..... N81-12309
F49620-79-C-0219 ..... N81-12831
F49620-80-C-0001 ..... N81-12767
F49620-80-C-0039 ..... N81-12909
GRI-5011-341-0121 ..... N81-12384
GSRI PROJ. 5011-343-0105 ..... N81-12643
JPL PROJ. 2365 ..... N81-12549
JPL-954559 ..... N81-12551
JPL-955217 ..... N81-12553
JPL-955324 ..... N81-12549
JPL-955354 ..... N81-12547
N81-12548
JPL-955409 ..... N81-12554
JPL-955498 ..... N81-12944
MBB-R-3700/2273-R N81-12420
MDA903-79-C-0939 ..... N81-12396
MDA903-80-C-0102 ..... N81-12334
M3J3XMA483011D N81-12154
NAG5-2 ..... N81-12790
NASA ORDER S-40255-B N81-12497
N81-12498
NASW-3199 ..... N81-12359
NAS1-13752 ..... N81-12405
NAS1-14214 ..... N81-12158
NAS1-14742 ..... N81-12225
NAS1-15007 ..... N81-12745
NAS1-15231 ..... N81-12016
NAS1-15516 ..... N81-12564
NAS1-16000 ..... N81-12022
NAS2-9332 ..... N81-12054
NAS2-9946 ..... N81-12110
NAS2-10417 ..... N81-12018
NAS3-19699 ..... N81-12135
N81-12136
N81-12137
NAS3-19746 ..... N81-12227
NAS3-20070 ..... N81-12086
NAS3-20073 ..... N81-12088
NAS3-20392 ..... N81-12135
N81-12136
NAS3-20591 ..... N81-12087
NAS3-20631 ..... N81-12085
NAS3-21370 ..... N81-12135
N81-12136
N81-12137
N81-12138
NAS3-21593 ..... N81-12255
NAS3-30292 ..... N81-12137
NAS5-20975 ..... N81-12391
NAS5-22497 ..... N81-12392
NAS5-23250 ..... N81-12864
NAS5-23500 ..... N81-12725
NAS5-23788 ..... N81-12683
NAS5-24121 ..... N81-12883
NAS5-24232 ..... N81-12495
NAS5-24264 ..... N81-12502
NAS5-24449 ..... N81-12863
NAS5-25453 ..... N81-12175
NAS5-25535 ..... N81-12385
NAS5-25759 ..... N81-12139
NAS5-25792 ..... N81-12157
NAS5-26047 ..... N81-12503
NAS7-100 ..... N81-12357
N81-12523
N81-12550
N81-12646
N81-12647
N81-12943
NAS8-25582 ..... N81-12746
NAS8-26749 ..... N81-12327
N81-12329
NAS8-28424 ..... N81-12697
N81-12698
NAS8-31325 ..... N81-12323
NAS8-31572 ..... N81-12326
NAS8-31958 ..... N81-12123
NAS8-32475 ..... N81-12560
NAS8-32527 ..... N81-12942
NAS8-32606 ..... N81-12524
NAS8-32912 ..... N81-12017
NAS8-32999 ..... N81-12161
NAS8-33023 ..... N81-12558
NAS8-33527 ..... N81-12133
NAS8-33818 ..... N81-12134
NAS9-14970 ..... N81-12496
NAS9-15325 ..... N81-12481
NAS9-15466 ..... N81-12496
N81-12504
N81-12520
NAS9-15800 ..... N81-12478
N81-12479
N81-12480
N81-12483
N81-12487
N81-12488
N81-12489
N81-12513
N81-12515
N81-12516
N81-12517
NAS12-2233 ..... N81-12328
NE-5061-012 ..... N81-12633
NE-5061-013 ..... N81-12634
N81-12801
NGL-22-009-124 ..... N81-12439
NGL-24-005-263 ..... N81-12505
NGL-38-002-053 ..... N81-12490
N81-12491
NGL-42-003-007 ..... N81-12511
NGL-50-002-127 ..... N81-12494
NGR-36-008-161 ..... N81-12669
NIVR-1068 ..... N81-12033
NIVR-1722 ..... N81-12252
NIVR-1744 ..... N81-12187
NR PROJ. 031-812 ..... N81-12452
NR PROJ. 049-456 ..... N81-12788
NR PROJ. 092-549 ..... N81-12228
NR PROJ. 099-407 ..... N81-12881
NR PROJ. 243-021 ..... N81-12913
NR PROJ. 356-593 ..... N81-12912
NR PROJ. 356-646 ..... N81-12230
NR PROJ. 395-504 ..... N81-12829
NRL PROJ. 0275-A-0 ..... N81-12556
NSF ATM-77-23111 ..... N81-12700
NSF ATM-78-17835 ..... N81-12703
NSF CHE-77-21305 ..... N81-12835
NSF ENG-77-12946 ..... N81-12805
NSF ENG-79-08351 ..... N81-12779
NSF MCS-77-02474 ..... N81-12750
NSF MCS-79-03554 ..... N81-12778
NSF MCS-79-04528 ..... N81-12334
NSF MCS-79-05774 ..... N81-12728
NSF PHY-80-08548 ..... N81-12828
NSG-033 ..... N81-12973
NSG-134-61 ..... N81-12684
NSG-1436 ..... N81-12786
NSG-1500 ..... N81-12140
NSG-1503 ..... N81-12120
N81-12121
NSG-1511 ..... N81-12019
NSG-1548 ..... N81-12360
NSG-1636 ..... N81-12447
NSG-1643 ..... N81-12675
NSG-3019 ..... N81-12997
NSG-3045 ..... N81-12105
NSG-3048 ..... N81-12103
NSG-3119 ..... N81-12100
NSG-3185 ..... N81-12172
NSG-5215 ..... N81-12684
NSG-5265 ..... N81-12525
NSG-7453 ..... N81-12492
NSR-09-012-106 ..... N81-12529
N00014-75-C-0476 ..... N81-12888
N00014-75-C-0690 ..... N81-12228
N00014-75-C-0730 ..... N81-12193
N00014-75-C-0756 ..... N81-12911
N81-12912
N00014-75-C-0809 ..... N81-12809
N00014-76-C-0004 ..... N81-12687
N00014-76-C-0139 ..... N81-12741
N00014-76-C-0279 ..... N81-12805
N00014-76-C-0302 ..... N81-12808
N00014-76-C-0439 ..... N81-12309
N00014-76-C-0447 ..... N81-12829
N00014-76-C-0625 ..... N81-12234
N00014-77-C-0018 ..... N81-12904
N81-12915
N00014-77-C-0102 ..... N81-12414
N00014-77-C-0180 ..... N81-12013

N00014-77-C-0224 ..... N81-12439
N00014-77-C-0311 ..... N81-12230
N00014-77-C-0543 ..... N81-12393
N00014-77-C-0553 ..... N81-12415
N81-12832
N00014-77-C-0664 ..... N81-12913
N00014-77-G-0034 ..... N81-12881
N00014-78-C-0468 ..... N81-12807
N00014-78-C-0674 ..... N81-12452
N00014-78-G-0036 ..... N81-12833
N00014-79-C-0009 ..... N81-12830
N00014-79-C-0341 ..... N81-12908
N00014-79-C-0494 ..... N81-12764
N00014-79-C-0507 ..... N81-12866
N00014-79-C-0598 ..... N81-12307
N00014-79-C-0624 ..... N81-12823
N00014-80-C-0221 ..... N81-12750
N81-12780
N81-12788
N00014-80-F-0035 ..... N81-12408
N00019-79-C-0136 ..... N81-12026
N00019-79-C-0366 ..... N81-12701
N00123-75-C-1075 ..... N81-12653
N00173-79-C-0025 ..... N81-12410
N60921-79-C-0276 ..... N81-12339
N62269-77-C-0442 ..... N81-12024
N62269-79-C-0037 ..... N81-12312
N62269-79-C-0277 ..... N81-12024
OSURF PROJ. 711055 ..... N81-12525
PROJ. AGRISTARS N81-12478
N81-12480
N81-12483
N81-12488
N81-12489
N81-12496
N81-12513
N81-12514
N81-12515
N81-12516
N81-12517
N81-12520
PROJ. SQUID N81-13010
N81-13011
PROJ. TELLUS N81-12521
N81-12522
RR0210203 ..... N81-12913
SC-77-AA-012674 ..... N81-12546
SNSF-2267-079 ..... N81-12801
SRC-GR/A/38847 ..... N81-12317
SRI PROJ. 1019 ..... N81-12777
SRI PROJ. 6824 ..... N81-12049
SRI PROJ. 7864 ..... N81-12530
W-31-107-ENG-38 ..... N81-12621
W-31-109-ENG-38 ..... N81-12204
N81-12216
N81-12280
N81-12461
N81-12592
N81-12617
N81-12618
N81-12619
N81-12620
N81-12622
N81-12656
N81-12659
N81-12705
N81-12854
N81-12898
N81-12953
N81-12954
W-31-109-38-4206 ..... N81-12954
W-31-109-38-4248 ..... N81-12953
W-7405-ENG-26 ..... N81-12214
N81-12459
N81-12654
N81-12660
N81-12819
N81-12838
N81-12839
N81-12858
N81-12891
N81-12920
N81-12921
N81-12922
W-7405-ENG-36 ..... N81-12275
N81-12369
N81-12398
N81-12624
N81-12625
N81-12793
N81-12847
N81-12872
N81-12960
W-7405-ENG-38 ..... N81-12614
W-7405-ENG-48 ..... N81-12202
N81-12342
N81-12427
N81-12587
N81-12835
N81-12842
N81-12859
N81-12917
N81-12927
W-7405-ENG-82 ..... N81-12218
N81-12429
N81-12918
N81-12923
N81-12924
W-7405-ENG-92 ..... N81-12534
WF21200000 ..... N81-12748
WF41401000 ..... N81-12903
ZF61544007 ..... N81-12903
141-20-20-10 ..... N81-12719
505-04 ..... N81-12089
505-05 ..... N81-12084
505-05-43-01 ..... N81-12356
505-06-33-10 ..... N81-12015
505-31-73-01 ..... N81-12021
505-32-03-04 ..... N81-12822
505-33-54 ..... N81-12066
505-34-33-06 ..... N81-12109
505-36-24 ..... N81-12744
505-43-24 ..... N81-12361
505-43-33-01 ..... N81-12448
506-53-43-01 ..... N81-12445
506-53-64 ..... N81-12064
506-62-43-05 ..... N81-12155
530-01-13-01 ..... N81-12012
530-04-13-01 ..... N81-12022
N81-12039
532-01-11 ..... N81-12054
533-01-13-06 ..... N81-12173
646-22-60 ..... N81-12135
N81-12136
N81-12137
953-36-00-00-72 ..... N81-12543
992-16-05-03 ..... N81-12761
992-21-01-90 ..... N81-12018

REPORT/ACCESSION NUMBER INDEX

Typical Report/Accession Number Index Listing



Listings in this index are arranged alphanumerically by report number. The NASA accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

AAAF-NT-79-24 ..... N81-12076 #
AAAF-NT-79-25 ..... N81-12463 #
AAAF-NT-79-29 ..... N81-12077 #
AAAF-NT-79-33 ..... N81-12464 #
AAAF-NT-79-34 ..... N81-12179 #
AAAF-NT-79-38 ..... N81-12180 #
AAAF-NT-79-41 ..... N81-12181 #
AAAF-NT-79-42 ..... N81-12154* #
AAAF-NT-79-43 ..... N81-12182 #
AAAF-NT-79-44 ..... N81-12183 #
AAAF-NT-79-45 ..... N81-12184 #
AAAF-NT-79-46 ..... N81-12078 #
AAAF-NT-80-01 ..... N81-12372 #
AAAF-NT-80-02 ..... N81-12373 #
AAAF-NT-80-03 ..... N81-12355
AAAF-NT-80-04 ..... N81-12374 #
AAAF-NT-80-09 ..... N81-12030 #
AAAF-NT-80-11 ..... N81-12111 #
AAAF-NT-80-12 ..... N81-12112 #
AAAF-NT-80-19 ..... N81-12031 #
AAAF-NT-80-23 ..... N81-12032 #
AAAF-NT-80-26 ..... N81-12079 #
AAAF-NT-80-28 ..... N81-12281 #

AAE-80-2 ..... N81-12262 #

ACUREX-78-315 ..... N81-12653 #

AD-A089484 ..... N81-12764 #
AD-A089585 ..... N81-12189 #
AD-A089688 ..... N81-12300 #
AD-A089693 ..... N81-12304 #
AD-A089728 ..... N81-12176 #
AD-A089777 ..... N81-12805 #
AD-A089823 ..... N81-12143 #
AD-A089826 ..... N81-12936 #
AD-A089837 ..... N81-12726 #
AD-A089848 ..... N81-12423 #
AD-A089937 ..... N81-12303 #
AD-A089947 ..... N81-12229 #
AD-A089964 ..... N81-12068 #
AD-A089980 ..... N81-12142 #
AD-A089985 ..... N81-12787 #
AD-A089992 ..... N81-12302 #
AD-A089997 ..... N81-12763 #
AD-A090020 ..... N81-12141 #
AD-A090023 ..... N81-12301 #
AD-A090044 ..... N81-12013 #
AD-A090116 ..... N81-12850 #
AD-A090128 ..... N81-12813 #
AD-A090144 ..... N81-12230 #
AD-A090155 ..... N81-12056 #
AD-A090168 ..... N81-12228 #
AD-A090280 ..... N81-12653 #
AD-A090281 ..... N81-12261 #
AD-A090282 ..... N81-12651 #
AD-A090283 ..... N81-12652 #
AD-A090284 ..... N81-12058 #
AD-A090285 ..... N81-12913 #
AD-A090287 ..... N81-12833 #
AD-A090302 ..... N81-12914 #
AD-A090312 ..... N81-12231 #
AD-A090313 ..... N81-12749 #
AD-A090321 ..... N81-12409 #
AD-A090322 ..... N81-12699 #
AD-A090326 ..... N81-12410 #
AD-A090327 ..... N81-12025 #
AD-A090329 ..... N81-12823 #
AD-A090330 ..... N81-12806 #
AD-A090331 ..... N81-12026 #
AD-A090334 ..... N81-12458 #
AD-A090335 ..... N81-12741 #
AD-A090336 ..... N81-12829 #
AD-A090338 ..... N81-12148 #
AD-A090339 ..... N81-12685 #
AD-A090340 ..... N81-12364 #
AD-A090341 ..... N81-12425 #
AD-A090343 ..... N81-12365 #
AD-A090344 ..... N81-12450 #
AD-A090346 ..... N81-12568 #
AD-A090347 ..... N81-12766 #
AD-A090351 ..... N81-12906 #
AD-A090355 ..... N81-12305 #
AD-A090356 ..... N81-12256 #
AD-A090357 ..... N81-12264 #
AD-A090359 ..... N81-12905 #
AD-A090360 ..... N81-12424 #
AD-A090361 ..... N81-12332 #
AD-A090366 ..... N81-12865 #
AD-A090368 ..... N81-12411 #
AD-A090375 ..... N81-12531 #
AD-A090377 ..... N81-12569 #
AD-A090378 ..... N81-12413 #
AD-A090384 ..... N81-12337 #
AD-A090389 ..... N81-12258 #
AD-A090391 ..... N81-12257 #
AD-A090393 ..... N81-12727 #
AD-A090394 ..... N81-12062 #
AD-A090396 ..... N81-12194 #
AD-A090398 ..... N81-12074 #
AD-A090401 ..... N81-12926 #
AD-A090406 ..... N81-12315 #
AD-A090407 ..... N81-12336 #
AD-A090412 ..... N81-12457 #
AD-A090413 ..... N81-12145 #
AD-A090418 ..... N81-12870 #
AD-A090420 ..... N81-12792 #
AD-A090424 ..... N81-12023 #
AD-A090425 ..... N81-12739 #
AD-A090426 ..... N81-12720 #
AD-A090427 ..... N81-12263 #
AD-A090429 ..... N81-12177 #
AD-A090431 ..... N81-12072 #
AD-A090433 ..... N81-12443 #
AD-A090435 ..... N81-12314 #
AD-A090436 ..... N81-12412 #
AD-A090437 ..... N81-12333 #
AD-A090439 ..... N81-12868 #
AD-A090440 ..... N81-12070 #
AD-A090441 ..... N81-12313 #
AD-A090443 ..... N81-12027 #
AD-A090449 ..... N81-12867 #
AD-A090465 ..... N81-12530 #
AD-A090467 ..... N81-12729 #
AD-A090472 ..... N81-12908 #
AD-A090484 ..... N81-12394 #
AD-A090487 ..... N81-12767 #
AD-A090488 ..... N81-12307 #
AD-A090496 ..... N81-12831 #
AD-A090497 ..... N81-12453 #
AD-A090500 ..... N81-12310 #
AD-A090506 ..... N81-12107 #
AD-A090507 ..... N81-12334 #
AD-A090508 ..... N81-12147 #
AD-A090511 ..... N81-12339 #
AD-A090512 ..... N81-12909 #
AD-A090514 ..... N81-12162 #
AD-A090515 ..... N81-12130 #
AD-A090516 ..... N81-12414 #
AD-A090520 ..... N81-12928 #
AD-A090525 ..... N81-12073 #
AD-A090528 ..... N81-12832 #
AD-A090529 ..... N81-12650 #
AD-A090536 ..... N81-12192 #
AD-A090537 ..... N81-12778 #
AD-A090543 ..... N81-12969 #
AD-A090544 ..... N81-12306 #
AD-A090546 ..... N81-12108 #
AD-A090547 ..... N81-12728 #
AD-A090548 ..... N81-12814 #
AD-A090550 ..... N81-12309 #
AD-A090552 ..... N81-12193 #
AD-A090553 ..... N81-12069 #
AD-A090558 ..... N81-12262 #
AD-A090559 ..... N81-12416 #
AD-A090561 ..... N81-12452 #
AD-A090569 ..... N81-12234 #
AD-A090572 ..... N81-12738 #
AD-A090574 ..... N81-12396 #
AD-A090576 ..... N81-12701 #
AD-A090577 ..... N81-12441 #
AD-A090582 ..... N81-12308 #
AD-A090583 ..... N81-12233 #
AD-A090584 ..... N81-12910 #
AD-A090585 ..... N81-12366 #
AD-A090588 ..... N81-12830 #
AD-A090589 ..... N81-12866 #
AD-A090594 ..... N81-12889 #
AD-A090598 ..... N81-12335 #
AD-A090603 ..... N81-12904 #
AD-A090604 ..... N81-12915 #
AD-A090606 ..... N81-12791 #
AD-A090607 ..... N81-12397 #
AD-A090615 ..... N81-12047 #
AD-A090617 ..... N81-12809 #
AD-A090625 ..... N81-12455 #
AD-A090626 ..... N81-12454 #
AD-A090636 ..... N81-12808 #
AD-A090641 ..... N81-12149 #
AD-A090642 ..... N81-12869 #
AD-A090643 ..... N81-12395 #
AD-A090644 ..... N81-12146 #
AD-A090645 ..... N81-12106 #
AD-A090646 ..... N81-12311 #
AD-A090647 ..... N81-12343 #
AD-A090648 ..... N81-12789 #
AD-A090649 ..... N81-12059 #
AD-A090650 ..... N81-12057 #
AD-A090664 ..... N81-12460 #
AD-A090674 ..... N81-12260 #
AD-A090675 ..... N81-12075 #
AD-A090676 ..... N81-12050 #
AD-A090677 ..... N81-12338 #
AD-A090684 ..... N81-12285 #
AD-A090685 ..... N81-12287 #
AD-A090686 ..... N81-12286 #
AD-A090688 ..... N81-12788 #
AD-A090689 ..... N81-12790* #
AD-A090698 ..... N81-12456 #
AD-A090705 ..... N81-12911 #
AD-A090706 ..... N81-12912 #
AD-A090709 ..... N81-12768 #
AD-A090711 ..... N81-12687 #
AD-A090712 ..... N81-12929 #
AD-A090713 ..... N81-12930 #
AD-A090714 ..... N81-12903 #
AD-A090716 ..... N81-12686 #

AD-A090717 ..... N81-12144 #
AD-A090718 ..... N81-12442 #
AD-A090725 ..... N81-12748 #
AD-A090732 ..... N81-12259 #
AD-A090733 ..... N81-12060 #
AD-A090735 ..... N81-12232 #
AD-A090748 ..... N81-12340 #
AD-A090749 ..... N81-12887 #
AD-A090750 ..... N81-12740 #
AD-A090751 ..... N81-12730 #
AD-A090756 ..... N81-12071 #
AD-A090760 ..... N81-12408 #
AD-A090761 ..... N81-12700 #
AD-A090762 ..... N81-12191 #
AD-A090766 ..... N81-12415 #
AD-A090770 ..... N81-12312 #
AD-A090771 ..... N81-12779 #
AD-A090772 ..... N81-12780 #
AD-A090773 ..... N81-12750 #
AD-A090775 ..... N81-12451 #
AD-A090776 ..... N81-12190 #
AD-A090778 ..... N81-12024 #
AD-A090781 ..... N81-12049 #
AD-A090787 ..... N81-12807 #
AD-A090789 ..... N81-12765 #
AD-A090790 ..... N81-12777 #
AD-A090793 ..... N81-12061 #
AD-A090799 ..... N81-12440 #
AD-A090803 ..... N81-12048 #
AD-A090805 ..... N81-12907 #
AD-A090806 ..... N81-12824 #
AD-A090807 ..... N81-12393 #
AD-A090810 ..... N81-12888 #

AD-E400474 ..... N81-12260 #
AD-E400479 ..... N81-12060 #
AD-E430494 ..... N81-12787 #
AD-E430509 ..... N81-12460 #
AD-E440086 ..... N81-12456 #
AD-E950039 ..... N81-12061 #

ADL-82340 ..... N81-12564* #

AERONOMICA-ACTA-A-206-1979 ..... N81-12670
AERONOMICA-ACTA-A-207-1979 ..... N81-12971
AERONOMICA-ACTA-A-208-1979 ..... N81-12696
AERONOMICA-ACTA-A-209-1979 ..... N81-12671
AERONOMICA-ACTA-A-211-1980 ..... N81-12972
AERONOMICA-ACTA-A-212-1980 ..... N81-12672
AERONOMICA-ACTA-A-214-1980 ..... N81-12673

AERONOMICA-ACTA-C-54-1979 ..... N81-12674

AESO-161-01-80 ..... N81-12653 #

AFESC/ESL-TR-79-30 ..... N81-12651 #
AFESC/ESL-TR-80-04 ..... N81-12653 #
AFESC/ESL-TR-80-21 ..... N81-12261 #
AFESC/ESL-TR-80-38 ..... N81-12652 #

AFFTC-TIH-77-1-VOL-1 ..... N81-12073 #
AFFTC-TIH-77-1-VOL-2 ..... N81-12073 #
AFFTC-TIH-79-2 ..... N81-12073 #

AFGL-AFSG-422 ..... N81-12148 #
AFGL-AFSG-426 ..... N81-12147 #

AFGL-ERP-696 ..... N81-12685 #
AFGL-ERP-701 ..... N81-12130 #
AFGL-ERP-707 ..... N81-12364 #

AFGL-TR-79-0236 ..... N81-12301 #
AFGL-TR-80-0066 ..... N81-12685 #
AFGL-TR-80-0088 ..... N81-12148 #
AFGL-TR-80-0163 ..... N81-12130 #
AFGL-TR-80-0168 ..... N81-12147 #
AFGL-TR-80-0173 ..... N81-12141 #
AFGL-TR-80-0186 ..... N81-12364 #

AFIT-79-247D ..... N81-12700 #

AFIT/DS/AA/80-1 ..... N81-12365 #
AFIT/DS/AA/80-2 ..... N81-12450 #

AFIT/DS/PH/80-1 ..... N81-12914 #

AFML-TR-79-4209 ..... N81-12453 #

AFOSR-80-0745TR ..... N81-12304 #
AFOSR-80-0755TR ..... N81-12107 #
AFOSR-80-0757TR ..... N81-12303 #
AFOSR-80-0866TR ..... N81-12805 #
AFOSR-80-0873TR ..... N81-12726 #
AFOSR-80-0934TR ..... N81-12416 #
AFOSR-80-0948TR ..... N81-12806 #
AFOSR-80-0950TR ..... N81-12300 #
AFOSR-80-0954TR ..... N81-12813 #
AFOSR-80-0993TR ..... N81-12779 #
AFOSR-80-1001TR ..... N81-12728 #
AFOSR-80-1002TR ..... N81-12814 #
AFOSR-80-1003TR ..... N81-12778 #
AFOSR-80-1005TR ..... N81-12192 #
AFOSR-80-1008TR ..... N81-12907 #
AFOSR-80-1012TR ..... N81-12309 #
AFOSR-80-1029TR ..... N81-12909 #
AFOSR-80-1041TR ..... N81-12108 #
AFOSR-80-1062TR ..... N81-12831 #
AFOSR-80-1064TR ..... N81-12262 #
AFOSR-80-1069TR ..... N81-12440 #
AFOSR-80-1070TR ..... N81-12451 #
AFOSR-80-1072TR ..... N81-12765 #

AFRPL-TR-80-37 ..... N81-12162 #

AFWAL-TR-80-1136 ..... N81-12306 #
AFWAL-TR-80-3007 ..... N81-12458 #
AFWAL-TR-80-3009 ..... N81-12050 #
AFWAL-TR-80-3019 ..... N81-12069 #
AFWAL-TR-80-3091 ..... N81-12025 #

AGARD-CP-281 ..... N81-12993 #

AGARD-INDEX-77-79 ..... N81-12935 #

AGARD-R-689 ..... N81-12115 #

AIRESEARCH-21-2953-2-VOL-2 ..... N81-12088* #

ALO-4121-2 ..... N81-12577 #

AMMRC-MS-80-4 ..... N81-12285 #
AMMRC-MS-80-5 ..... N81-12287 #
AMMRC-MS-80-6 ..... N81-12286 #

AMMRC-TR-80-41 ..... N81-12454 #
AMMRC-TR-80-42 ..... N81-12455 #
AMMRC-TR-80-43 ..... N81-12229 #

ANL-K-79-4917-1 ..... N81-12618 #

ANL-TRANS-1190 ..... N81-12212 #

ANL-79-94 ..... N81-12614 #
ANL-80-5 ..... N81-12216 #
ANL-80-26 ..... N81-12461 #
ANL-80-41 ..... N81-12615 #
ANL-80-73 ..... N81-12854 #
ANL-80-80 ..... N81-12622 #

ANL/AA-17 ..... N81-12621 #

ANL/CEN/FE-79-14 ..... N81-12280 #
ANL/CEN/FE-80-11 ..... N81-12204 #

ANL/ECT-9 ..... N81-12620 #

ANL/EES-TM-90-VOL-3 ..... N81-12656 #

ANL/ES-90 ..... N81-12619 #
ANL/ES-92 ..... N81-12592 #

ANL/MHD-80-1 ..... N81-12898 #

ANL/MSD/FE-80-4 ..... N81-12617 #

ANL/OEPM-79-7 ..... N81-12954 #
ANL/OEPM-79-10 ..... N81-12953 #

ANL/RAS/LWR-79-7 ..... N81-12370 #

ANL/SPG-9 ..... N81-12279 #

AQ-100 ..... N81-12668 #

AR-3 ..... N81-12832 #
AR-002-012 ..... N81-12299
AR-1979-2 ..... N81-12953 #

ARAP-420 ..... N81-12701 #

ARBRL-CR-00433 ..... N81-12787 #

ARBRL-MR-03050 ..... N81-12460 #
ARBRL-MR-03052 ..... N81-12142 #

ARC-R/M-3848 ..... N81-12113 #

ARC-38234 ..... N81-12113 #

ARDU-TI-698 ..... N81-12068 #

ARLCB-TR-80011 ..... N81-12456 #

ARLCD-CR-80025 ..... N81-12260 #

ARO-13367.4-EX ..... N81-12366 #
ARO-14043.10-GS ..... N81-12310 #
ARO-14270.9-EL ..... N81-12308 #
ARO-14515.5-E ..... N81-12233 #
ARO-15882.21-M ..... N81-12190 #
ARO-16863.1-A-EL ..... N81-12910 #
ARO-17127.1-A-EL ..... N81-12777 #

ARSCD-MR-80002 ..... N81-12060 #

ASC-R-126 ..... N81-12013 #

ASR-2 ..... N81-12833 #

ATC-R-91000/9CR-66 ..... N81-12026 #
ATC-R-91100/9CR-71 ..... N81-12024 #

ATC-103-FR ..... N81-12189 #

ATR-79(7642)-3 ..... N81-12683* #

AVRADCOM-TR-80-A-14 ..... N81-12018* #
AVRADCOM-TR-80-C-15 ..... N81-12210* #

AVSD-0154-80-RR ..... N81-12427 #

AWRE-O-16/80 ..... N81-12753 #
AWRE-O-21/80 ..... N81-12351 #
AWRE-O-27/80 ..... N81-12692 #

BAE-ESA/B44/40013 ..... N81-12472 #

BDX-613-2277 ..... N81-12289 #
BDX-613-2339 ..... N81-12219 #
BDX-613-2354 ..... N81-12241 #
BDX-613-2382 ..... N81-12288 #
BDX-613-2393 ..... N81-12206 #
BDX-613-2394 ..... N81-12245 #
BDX-613-2395 ..... N81-12345 #
BDX-613-2405 ..... N81-12246 #
BDX-613-2407 ..... N81-12178 #
BDX-613-2408 ..... N81-12244 #
BDX-613-2411 ..... N81-12205 #
BDX-613-2422 ..... N81-12341 #
BDX-613-2432 ..... N81-12240 #
BDX-613-2435 ..... N81-12217 #
BDX-613-2442 ..... N81-12430 #
BDX-613-2444 ..... N81-12431 #
BDX-613-2447 ..... N81-12432 #
BDX-613-2448 ..... N81-12418 #
BDX-613-2476 ..... N81-12417 #
BDX-613-2484 ..... N81-12794 #
BDX-613-2489 ..... N81-12344 #

BE-79-808 ..... N81-12385* #

BLL-TRANS-1434-(9022.549)-PT-2 ..... N81-12695

BMFT-FB-DV-79-05 ..... N81-12931 #
BMFT-FB-DV-79-07 ..... N81-12347 #
BMFT-FB-DV-79-10 ..... N81-12348 #

BMFT-FB-ID-79-05 ..... N81-12781 #

BMFT-FB-T-79-51 ..... N81-12291 #
BMFT-FB-T-79-52 ..... N81-12925 #
BMFT-FB-T-79-55 ..... N81-12346 #
BMFT-FB-T-79-57 ..... N81-12629 #
BMFT-FB-T-80-036 ..... N81-12236 #

BMI-2059 ..... N81-12213 #

BMO-TR-80-12 ..... N81-12441 #

BNL-25536 ..... N81-12400 #

BNL-27326 ..... N81-12844 #
BNL-28048 ..... N81-12799 #
BNL-28054 ..... N81-12860 #
BNL-28149 ..... N81-12722 #
BNL-28154 ..... N81-12594 #
BNL-28186 ..... N81-12852 #
BNL-28192 ..... N81-12595 #
BNL-28195 ..... N81-12876 #
BNL-28198 ..... N81-12836 #
BNL-28267 ..... N81-12399 #
BNL-28279 ..... N81-12845 #
BNL-28282 ..... N81-12861 #
BNL-28297 ..... N81-12277 #
BNL-51105 ..... N81-12612 #
BNL-51110 ..... N81-12662 #
BNL-51127 ..... N81-12613 #
BNL-51155 ..... N81-12237 #
BNL-51189 ..... N81-12663 #
BNL-51195 ..... N81-12661 #
BNL-51222 ..... N81-12316 #
BNL-51223 ..... N81-12203 #
BNL-51233 ..... N81-12278 #

BR72727 ..... N81-12772 #
BR73471 ..... N81-12353 #
BR73507 ..... N81-12753 #
BR73977 ..... N81-12320 #
BR74344 ..... N81-12469 #
BR74346 ..... N81-12539 #
BR74521 ..... N81-12468 #
BR74602 ..... N81-12282 #
BR74612 ..... N81-12248 #
BR74671 ..... N81-12470 #
BR74775 ..... N81-12122 #
BR74909 ..... N81-12038 #
BR74910 ..... N81-12693 #
BR74911 ..... N81-12932 #
BR74953 ..... N81-12153 #
BR74998 ..... N81-12692 #
BR75017 ..... N81-12351 #
BR75034 ..... N81-12319 #
BR75035 ..... N81-12775 #
BR75056 ..... N81-12734 #
BR75080 ..... N81-12737 #
BR75265 ..... N81-12167 #
BR75309 ..... N81-12037 #
BR75369 ..... N81-12827 #
BR75505 ..... N81-12132 #
BR75534 ..... N81-12771 #

BSDF-38-3Q-80 ..... N81-12195 #

CCVS74-VSR615 ..... N81-12759 #

CE-FBR-80-019 ..... N81-12265 #

CISE-N-187 ..... N81-12901 #
CISE-N-189 ..... N81-12419 #
CISE-N-191 ..... N81-12820 #
CISE-N-192 ..... N81-12877 #

CISE-1517 ..... N81-12630 #
CISE-1529 ..... N81-12403 #
CISE-1531 ..... N81-12462 #
CISE-1533 ..... N81-12371 #

CML-80-1 ..... N81-12172* #

CONF-790418-2 ..... N81-12400 #
CONF-790512-1 ..... N81-12570 #
CONF-790568-2 ..... N81-12289 #
CONF-790696-VOL-2 ..... N81-12835 #
CONF-790779 ..... N81-12169 #
CONF-790885-20 ..... N81-12843 #
CONF-791199-SUMM ..... N81-12611 #
CONF-791204-39 ..... N81-12705 #
CONF-800383 ..... N81-12590 #
CONF-800410 ..... N81-12219 #
CONF-800419-5 ..... N81-12267 #
CONF-800482-5 ..... N81-12534 #
CONF-800587-5 ..... N81-12342 #
CONF-800633-3 ..... N81-12573 #
CONF-800655-29 ..... N81-12860 #
CONF-800699-4 ..... N81-12891 #
CONF-800724-17 ..... N81-12840 #
CONF-800724-18 ..... N81-12837 #
CONF-800740-14 ..... N81-12834 #
CONF-800743-1 ..... N81-12861 #
CONF-800762-1 ..... N81-12722 #
CONF-800763-1 ..... N81-12836 #
CONF-800764-1 ..... N81-12852 #
CONF-800767-2 ..... N81-12872 #
CONF-800804-21 ..... N81-12290 #
CONF-800820-1 ..... N81-12733 #
CONF-800844-1 ..... N81-12242 #
CONF-800847-1 ..... N81-12594 #
CONF-800853-1 ..... N81-12960 #
CONF-800859-1 ..... N81-12838 #
CONF-800859-2 ..... N81-12871 #
CONF-800859-3 ..... N81-12922 #
CONF-800864-1 ..... N81-12839 #
CONF-800907-2 ..... N81-12214 #
CONF-800908-2 ..... N81-12921 #
CONF-800952-1 ..... N81-12818 #
CONF-800954-2 ..... N81-12924 #
CONF-800954-3 ..... N81-12923 #
CONF-800955-1 ..... N81-12243 #
CONF-800955-2 ..... N81-12623 #
CONF-800955-3 ..... N81-12401 #
CONF-800955-4 ..... N81-12402 #
CONF-800969-1 ..... N81-12459 #
CONF-800973-2 ..... N81-12277 #
CONF-800976-1 ..... N81-12845 #
CONF-801016-6 ..... N81-12624 #
CONF-801018-8 ..... N81-12625 #
CONF-801016-14 ..... N81-12595 #
CONF-801033-1 ..... N81-12367 #
CONF-801048-5 ..... N81-12276 #
CONF-801055-1 ..... N81-12575 #
CONF-801107-11 ..... N81-12798 #
CONF-7908122-1 ..... N81-12572 #
CONF-7909167-1 ..... N81-12704 #
CONF-8004105-1 ..... N81-12916 #
CONF-8005108-1 ..... N81-12429 #
CONF-8005109-1(DRAFT) ..... N81-12920 #
CONF-8006111-1 ..... N81-12842 #
CONF-8006113-1 ..... N81-12875 #

CONS-4209-T1-VOL-9 ..... N81-12949 #
CONS-5157-T1 ..... N81-12589 #
CONS-5160-T1 ..... N81-12571 #

CONTRIB-6314 ..... N81-12830 #

COO-1340-74 ..... N81-12689 #
COO-1340-75 ..... N81-12702 #
COO-2387-113 ..... N81-12897 #
COO-2426-205 ..... N81-12265 #
COO-2566-53-T1 ..... N81-12950 #
COO-3496-75 ..... N81-12841 #
COO-4381-10 ..... N81-12873 #
COO-5002-10 ..... N81-12919 #

CRI-110 ..... N81-12752 #

CTH-MATH-1980-3 ..... N81-12815 #
CTH-MATH-1980-4 ..... N81-12185 #
CTH-MATH-1980-5 ..... N81-12810 #
CTH-MATH-1980-6 ..... N81-12816 #

C80-636/501 ..... N81-12410 #

DCIEM-80-R-28 ..... N81-12738 #
DCIEM-80-R-32 ..... N81-12729 #

DDA-EDR-10339 ..... N81-12108 #

DDC-823-279-FR-00-357 ..... N81-12863* #

DELET-TR-79-0251-1 ..... N81-12302 #
DELET-TR-80-15 ..... N81-12568 #

DFVLR-FB-79-10 ..... N81-12691 #
DFVLR-FB-79-14 ..... N81-12536 #
DFVLR-FB-79-15 ..... N81-12151 #
DFVLR-FB-79-20 ..... N81-12080 #

DFVLR-MITT-79-06 ..... N81-12690 #
DFVLR-MITT-80-01 ..... N81-12035 #
DFVLR-MITT-80-08 ..... N81-12063 #

DLR-FB-77-50 ..... N81-12222 #

DMA/TR-80-001 ..... N81-12969 #

DOE-TR-229 ..... N81-12951 #

DOE/BETC-RI-80/1 ..... N81-12268 #
DOE/BETC-RI-80/7 ..... N81-12270 #
DOE/CS-3107/T2 ..... N81-12215 #
DOE/CS-20097/01 ..... N81-12580 #
DOE/CS-20189/1 ..... N81-12593 #
DOE/CS-30118/T3 ..... N81-12596 #
DOE/CS-30377/1 ..... N81-12583 #
DOE/CS-34136/1 ..... N81-12606 #
DOE/CS-34412/18 ..... N81-12584 #
DOE/CS-50069/1 ..... N81-12051 #

DOE/EA-0117 ..... N81-12655 #

DOE/EG-34135/10 ..... N81-12585 #

DOE/ER-0072 ..... N81-12659 #
DOE/ER-0075 ..... N81-12856 #
DOE/ER-01198/1311 ..... N81-12916 #
DOE/ER-02232/89 ..... N81-12837 #
DOE/ER-02232/90 ..... N81-12840 #
DOE/ER-04060/T1 ..... N81-12168 #
DOE/ER-10082/T1 ..... N81-12271 #
DOE/ER-10364/12 ..... N81-12853 #
DOE/ER-10575/1 ..... N81-12874 #

DOE/ET-12548/1 ..... N81-12523* #
DOE/ET-14858/2 ..... N81-12266 #
DOE/ET-14881/2 ..... N81-12273 #
DOE/ET-15303/T3 ..... N81-12199 #
DOE/ET-15303/T4 ..... N81-12198 #
DOE/ET-21019/T1 ..... N81-12599 #
DOE/ET-23013/T5 ..... N81-12597 #
DOE/ET-23048/T1 ..... N81-12603 #
DOE/ET-23108/4 ..... N81-12601 #
DOE/ET-27224/T1 ..... N81-12658 #
DOE/ET-28455/3 ..... N81-12604 #

DOE/EV-0094 ..... N81-12201 #
DOE/EV-01340/T1 ..... N81-12703 #
DOE/EV-01340/T2 ..... N81-12657 #
DOE/EV-01340/T3 ..... N81-12688 #
DOE/EV-03861/T1 ..... N81-12200 #
DOE/EV-03941/52 ..... N81-12721 #
DOE/EV-10291/T1 ..... N81-12274 #
DOE/EV-10303/5 ..... N81-12731 #

DOE/IA-0010/2 ..... N81-12588 #

DOE/IR-06065/1-PT-1 ..... N81-12582 #

DOE/JPL-954559-78/7 ..... N81-12551* #
DOE/JPL-954854-80/8 ..... N81-12552* #
DOE/JPL-955217-80/5 ..... N81-12553* #
DOE/JPL-955324-80/4 ..... N81-12549* #
DOE/JPL-955409-80/1 ..... N81-12554* #
DOE/JPL-955498-1 ..... N81-12944* #

DOE/METC-RI-80-17 ..... N81-12591 #

DOE/NASA/0179-1 ..... N81-12546* #

DOE/NE-0007-SUPPL-1 ..... N81-12855 #

DOE/NV-10061/3 ..... N81-12851 #

DOE/OR-05035/T1 ..... N81-12426 #

DOE/PC-30072/T1 ..... N81-12272 #

DOE/RA-04934/05 ..... N81-12611 #
DOE/RA-28320/1 ..... N81-12579 #

DOE/RG-10075/T1 ..... N81-12269 #

DOE/RS-10114/1 ..... N81-12581 #
DOE/RS-10143/1 ..... N81-12605 #

DOE/SERI/8229-3/2-T6 ..... N81-12602 #

DOE/SF-0113/4 ..... N81-12533 #
DOE/SF-10738-1/2 ..... N81-12600 #
DOE/SF-10738/1-3 ..... N81-12598 #

DOE/TIC-11225 ..... N81-12202 #

DP-MS/79-78 ..... N81-12290 #

DRSMI/RG-80-23-TR ..... N81-12061 #

DS-ERT-14/80 ..... N81-12381 #

D6-46699 ..... N81-12225* #

D180-25945-1 ..... N81-12726 #
D210-11591-1 ..... N81-12075 #

E-417 ..... N81-12089* #
E-477 ..... N81-12090* #
E-489 ..... N81-12978* #
E-525 ..... N81-12226* #
E-538 ..... N81-12210* #
E-570 ..... N81-12171* #
E-613 ..... N81-12821* #
E-631 ..... N81-12358* #
E-633 ..... N81-12446* #
E-637 ..... N81-12817* #
E-9542 ..... N81-12084* #

EAI-TR-80-002 ..... N81-12134* #

ECI-TID-4500 ..... N81-12237 #

ECN-77 ..... N81-12902 #

ECRC/M1266 ..... N81-12349 #

ECTES-TID-4500 ..... N81-12661 #

EDD-W-08146 ..... N81-12340 #

EIR-00733 ..... N81-12082

ENST-C-79020 ..... N81-12782 #

ENST-D-79024 ..... N81-12776

EPA-550/9-70-313-2 ..... N81-12645 #
EPA-550/9-79-313-1 ..... N81-12644 #
EPA-600/1-78-050 ..... N81-12660 #
EPA-600/3-80-024 ..... N81-12663 #

EPRI-EL-1500 ..... N81-12368 #

ERC41026/1PR ..... N81-12908 #

ERG-031 ..... N81-12632 #

ERL-177 ..... N81-12512* #
ERL-179 ..... N81-12519* #
ERL-0146-TR N81-12299

ERSAL-80-1 ..... N81-12491* #

ER78-4392-1 ..... N81-12697* #
ER78-4392-2 ..... N81-12698* #

ESA-CR(P)-1243-REV-B ..... N81-12350 #
ESA-CR(P)-1340 ..... N81-12379 #
ESA-CR(P)-1348 ..... N81-12163 #
ESA-CR(P)-1351 ..... N81-12752 #
ESA-CR(P)-1354-VOL-1 ..... N81-12128 #
ESA-CR(P)-1354-VOL-2 ..... N81-12129 #
ESA-CR(P)-1356 ..... N81-12754 #
ESA-CR(P)-1357 ..... N81-12164 #
ESA-CR(P)-1358 ..... N81-12770 #
ESA-CR(P)-1359 ..... N81-12380 #
ESA-CR(P)-1361 ..... N81-12381 #
ESA-CR(P)-1363 ..... N81-12152 #
ESA-CR(P)-1365 ..... N81-12165 #
ESA-CR(P)-1366 ..... N81-12472 #
ESA-CR(P)-1367 ..... N81-12420 #
ESA-CR(P)-1368 ..... N81-12159 #
ESA-CR(P)-1369-VOL-1 ..... N81-12711 #
ESA-CR(P)-1369-VOL-2 ..... N81-12712 #
ESA-CR(P)-1369-VOL-3 ..... N81-12713 #
ESA-CR(P)-1370 ..... N81-12166 #
ESA-CR(P)-1371 ..... N81-12160 #
ESA-CR(P)-1375 ..... N81-12537 #

ESA-PSS-26/QRM-21T-ESTEC-ISS-2 . N81-12208 #

ESA-SP-1032 ..... N81-12992 #

ESA-STM-213 ..... N81-12251 #

ESA-STR-205 ..... N81-12631 #

ESA-TT-507 ..... N81-12222 #
ESA-TT-615 ..... N81-12690 #
ESA-TT-623 ..... N81-12691 #
ESA-TT-627 ..... N81-12536 #
ESA-TT-628 ..... N81-12151 #
ESA-TT-631 ..... N81-12080 #
ESA-TT-635 ..... N81-12292 #
ESA-TT-636 ..... N81-12352 #
ESA-TT-638 ..... N81-12207 #
ESA-TT-639 ..... N81-12826 #

ESD-TR-80-68 ..... N81-12056 #
ESD-TR-80-81 ..... N81-12143 #
ESD-TR-80-88 ..... N81-12790* #

ESS/SS-957 ..... N81-12152 #
ESS/SS-983 ..... N81-12754 #

ETL-0235 ..... N81-12530 #

ETS-53 ..... N81-12143 #

EUR-6737-EN ..... N81-12235 #

E81-10001 ..... N81-12478* #
E81-10002 ..... N81-12479* #
E81-10003 ..... N81-12480* #
E81-10004 ..... N81-12481* #
E81-10005 ..... N81-12482* #
E81-10006 ..... N81-12483* #
E81-10007 ..... N81-12484* #
E81-10008 ..... N81-12485* #
E81-10009 ..... N81-12486* #
E81-10010 ..... N81-12487* #
E81-10011 ..... N81-12488* #
E81-10012 ..... N81-12489* #
E81-10013 ..... N81-12490* #
E81-10014 ..... N81-12491* #
E81-10015 ..... N81-12492* #
E81-10016 ..... N81-12493* #
E81-10017 ..... N81-12494* #
E81-10018 ..... N81-12495* #
E81-10019 ..... N81-12496* #
E81-10020 ..... N81-12497* #
E81-10021 ..... N81-12498* #
E81-10022 ..... N81-12499* #
E81-10023 ..... N81-12500* #
E81-10024 ..... N81-12501* #
E81-10025 ..... N81-12502* #
E81-10026 ..... N81-12503* #
E81-10027 ..... N81-12504* #
E81-10028 ..... N81-12505* #
E81-10029 ..... N81-12511* #
E81-10030 ..... N81-12512* #
E81-10031 ..... N81-12513* #
E81-10032 ..... N81-12514* #
E81-10033 ..... N81-12515* #
E81-10034 ..... N81-12516* #
E81-10035 ..... N81-12517* #
E81-10036 ..... N81-12518* #
E81-10037 ..... N81-12519* #
E81-10038 ..... N81-12520* #
E81-10039 ..... N81-12521* #
E81-10040 ..... N81-12522* #

FAA-AVP-79-11 ..... N81-12049 #
FAA-AVP-80-1 ..... N81-12047 #
FAA-AVP-80-4 ..... N81-12048 #

FC-JO-00468 ..... N81-12517* #

FC-LO-00428 ..... N81-12516* #
FC-LO-00437 ..... N81-12480* #
FC-LO-00609 ..... N81-12513* #

FE-2018-17 ..... N81-12197 #

FERMILAB-CONF-79/85-EXP ..... N81-12843 #

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FOK-R-2464 ..... N81-12250 #

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FOK-RV-79-24 ..... N81-12444 #

FR-1 ..... N81-12139* #
FR-1 ..... N81-12393 #
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FR-13019 ..... N81-12426 #
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GEPP-TIS-516 ..... N81-12239 #

GPO-50-111 ..... N81-12946 #
GPO-51-381 ..... N81-12055 #
GPO-51-683 ..... N81-12557 #
GPO-53-938 ..... N81-12940 #
GPO-56-236 ..... N81-12284 #
GPO-56-764 ..... N81-12849 #
GPO-57-523 ..... N81-12563 #
GPO-57-671 ..... N81-12945 #
GPO-58-034 ..... N81-12947 #
GPO-58-154 ..... N81-12555 #
GPO-60-512 ..... N81-12041 #
GPO-60-580 ..... N81-12567 #
GPO-61-252 ..... N81-12566 #
GPO-61-316 ..... N81-12649 #
GPO-61-544 ..... N81-12562 #
GPO-62-976 ..... N81-12948 #
GPO-62-991 ..... N81-12561 #
GPO-63-136 ..... N81-12648 #
GPO-64-551 ..... N81-12565 #
GPO-66-074 ..... N81-12406 #
GPO-66-705 ..... N81-12937 #
GPO-66-883 ..... N81-12941 #
GPO-68-636 ..... N81-12939 #
GPO-68-717 ..... N81-12040 #
GPO-68-972 ..... N81-12938 #

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H-1084 ..... N81-12744* #
H-1101 ..... N81-12361* #
H-1108 ..... N81-12066* #
H-1138 ..... N81-12064* #

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IG-PUBL-638 ..... N81-12664 #

IITRI-J6432-F ..... N81-12260 #

ILIR-1792 ..... N81-12306 #

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IPF-78-7 ..... N81-12899 #
IPF-79-3 ..... N81-12900 #

IPPJ-478 ..... N81-12884 #
IPPJ-479 ..... N81-12886
IPPJ-480 ..... N81-12885 #

IR-FY-80 ..... N81-12408 #

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IS-M-293 ..... N81-12924 #
IS-M-295 ..... N81-12923 #

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IS-4722 ..... N81-12218 #

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ISD-261 ..... N81-12628 #

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ISSN-0170-6071 ..... N81-12628 #
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ITR-1 ..... N81-12302 #
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JPL-9950-445 ..... N81-12553* #
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JPL-9950-450 ..... N81-12552* #
JPL-9950-452 ..... N81-12551* #

JSC-13821-VOL-2-REV-A ..... N81-12487* #
JSC-16343 ..... N81-12516* #
JSC-16351 ..... N81-12480* #
JSC-16359 ..... N81-12489* #
JSC-16364 ..... N81-12513* #
JSC-16370 ..... N81-12515* #
JSC-16371 ..... N81-12517* #
JSC-16376 ..... N81-12478* #
JSC-16750 ..... N81-12488* #
JSC-16754 ..... N81-12483* #
JSC-16807 ..... N81-12479* #
JSC-16817 ..... N81-12514* #

KNMI-WR-80-3 ..... N81-12706 #

L-12320 ..... N81-12356* #
L-12976 ..... N81-12015* #
L-13507 ..... N81-12812* #
L-13738 ..... N81-12109* #
L-13868 ..... N81-12021* #
L-13872 ..... N81-12448* #
L-13881 ..... N81-12043* #
L-13960 ..... N81-12012* #

LA-UR-80-2039 ..... N81-12872 #
LA-UR-80-2267 ..... N81-12625 #
LA-UR-80-2340 ..... N81-12624 #
LA-UR-80-2357 ..... N81-12960 #

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LA-8374-MS ..... N81-12847 #
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LA-8410-MS ..... N81-12369 #

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LBL-10651 ..... N81-12917 #
LBL-10755 ..... N81-12834 #
LBL-10761 ..... N81-12342 #
LBL-11232 ..... N81-12842 #
LBL-11252 ..... N81-12875 #
LBL-11276 ..... N81-12871 #
LBL-11320 ..... N81-12859 #
LBL-11393 ..... N81-12818 #

LC-78-27848 ..... N81-12518* #

LDGO-CU-13-80 ..... N81-12687 #

LEMSCO-12564-VOL-2-REV-A ..... N81-12487* #
LEMSCO-14067 ..... N81-12516* #
LEMSCO-14584 ..... N81-12480* #
LEMSCO-14673 ..... N81-12489* #
LEMSCO-14676 ..... N81-12478* #
LEMSCO-15042 ..... N81-12513* #
LEMSCO-15151 ..... N81-12488* #
LEMSCO-15163 ..... N81-12483* #
LEMSCO-15179 ..... N81-12515* #
LEMSCO-15353 ..... N81-12479* #

LIDS-TH-1055 ..... N81-12439* #

LMSC-D766177 ..... N81-12157* #

LOG-C3932 ..... N81-12020 #

LOG-E379 ..... N81-12881 #
LOG-E421 ..... N81-12556 #

LOG-J6857 ..... N81-12188 #

M-268 ..... N81-12760* #

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MIMEO-SER-1284 ..... N81-12809 #

MRC-DA-934 ..... N81-12191 #

MRC-SL-1007 ..... N81-12227* #

MSSU-EIRS-ASE-80-6 ..... N81-12017* #

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MTR-80W108 ..... N81-12658 #
MTR-3843 ..... N81-12791 #

MVEE-MEMO-71061 ..... N81-12122 #
MVEE-MEMO-79021 ..... N81-12122 #

NADC-79119-60 ..... N81-12024 #
NADC-80110-50 ..... N81-12748 #

NAE-LR-600 ..... N81-12394 #

NAL-TR-611T N81-12449

NASA-CASE-GSC-12551-1 ..... N81-12156* #
NASA-CASE-GSC-12592-1 ..... N81-12407* #
NASA-CASE-GSC-12595-1 ..... N81-12331* #
NASA-CASE-GSC-12608-1 ..... N81-12387* #
NASA-CASE-GSC-12614-1 ..... N81-12386* #

NASA-CASE-KSC-11104-1 ..... N81-12862* #

NASA-CASE-LAR-12321-1 ..... N81-12390* #
NASA-CASE-LAR-12361-1 ..... N81-12422* #
NASA-CASE-LAR-12363-1 ..... N81-12389* #
NASA-CASE-LAR-12469-1 ..... N81-12388* #
NASA-CASE-LAR-12471-1 ..... N81-12724* #
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NASA-CASE-LAR-12742-1 ..... N81-12174* #

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NASA-CASE-LEW-13174-1 ..... N81-12363* #
NASA-CASE-LEW-13339-1 ..... N81-12211* #

NASA-CASE-MFS-25134-1 ..... N81-12283* #
NASA-CASE-MFS-25535-1 ..... N81-12330* #

NASA-CP-2137 ..... N81-12090* #
NASA-CP-2149 ..... N81-12978* #

NASA-CR-3005 ..... N81-12014* #
NASA-CR-3340 ..... N81-12360* #
NASA-CR-3343 ..... N81-12158* #
NASA-CR-3347 ..... N81-12560* #
NASA-CR-3348 ..... N81-12558* #
NASA-CR-3355 ..... N81-12105* #
NASA-CR-3357 ..... N81-12022* #
NASA-CR-3361 ..... N81-12564* #
NASA-CR-150783 ..... N81-12323* #
NASA-CR-150799 ..... N81-12328* #
NASA-CR-150801 ..... N81-12746* #
NASA-CR-150825 ..... N81-12329* #
NASA-CR-150884 ..... N81-12942* #
NASA-CR-150901 ..... N81-12326* #
NASA-CR-152306 ..... N81-12110* #
NASA-CR-152409 ..... N81-12054* #
NASA-CR-156873 ..... N81-12677* #
NASA-CR-158430 ..... N81-12016* #
NASA-CR-158954 ..... N81-12225* #
NASA-CR-159310 ..... N81-12405* #
NASA-CR-159324 ..... N81-12745* #
NASA-CR-159372 ..... N81-12120* #
NASA-CR-159376 ..... N81-12121* #
NASA-CR-159382 ..... N81-12019* #
NASA-CR-159499 ..... N81-12086* #
NASA-CR-159562 ..... N81-12088* #
NASA-CR-159794 ..... N81-12227* #
NASA-CR-159867 ..... N81-12085* #
NASA-CR-159879 ..... N81-12087* #
NASA-CR-159884 ..... N81-12172* #
NASA-CR-160037 ..... N81-12175* #
NASA-CR-160042 ..... N81-12863* #
NASA-CR-160043 ..... N81-12391* #
NASA-CR-160044 ..... N81-12864* #
NASA-CR-160047 ..... N81-12883* #
NASA-CR-160050 ..... N81-12725* #
NASA-CR-160051 ..... N81-12385* #
NASA-CR-160052 ..... N81-12683* #
NASA-CR-160056 ..... N81-12157* #
NASA-CR-160059 ..... N81-12392* #
NASA-CR-160776 ..... N81-12483* #
NASA-CR-160777 ..... N81-12513* #
NASA-CR-161277 ..... N81-12327* #
NASA-CR-161588 ..... N81-12545* #
NASA-CR-161589 ..... N81-12544* #
NASA-CR-161597 ..... N81-12133* #
NASA-CR-161604 ..... N81-12134* #
NASA-CR-161607 ..... N81-12524* #
NASA-CR-161608 ..... N81-12161* #
NASA-CR-161609 ..... N81-1201** #
NASA-CR-161610 ..... N81-12698* #
NASA-CR-161611 ..... N81-12697* #
NASA-CR-161612 ..... N81-12123* #
NASA-CR-163099 ..... N81-12067* #
NASA-CR-163441 ..... N81-12501* #
NASA-CR-163445 ..... N81-12504* #
NASA-CR-163502 ..... N81-12503* #
NASA-CR-163503 ..... N81-12502* #
NASA-CR-163504 ..... N81-12499* #
NASA-CR-163505 ..... N81-12498* #
NASA-CR-163506 ..... N81-12497* #
NASA-CR-163507 ..... N81-12496* #
NASA-CR-163510 ..... N81-12495* #
NASA-CR-163511 ..... N81-12484* #
NASA-CR-163527 ..... N81-12494* #
NASA-CR-163528 ..... N81-12485* #
NASA-CR-163529 ..... N81-12511* #
NASA-CR-163530 ..... N81-12505* #
NASA-CR-163531 ..... N81-12518* #
NASA-CR-163532 ..... N81-12492* #
NASA-CR-163533 ..... N81-12490* #
NASA-CR-163534 ..... N81-12491* #
NASA-CR-163544 ..... N81-12522* #

NASA-CR-163545 ..... N81-12482* #
NASA-CR-163546 ..... N81-12521* #
NASA-CR-163551 ..... N81-12520* #
NASA-CR-163552 ..... N81-12517* #
NASA-CR-163553 ..... N81-12481* #
NASA-CR-163554 ..... N81-12516* #
NASA-CR-163555 ..... N81-12489* #
NASA-CR-163556 ..... N81-12515* #
NASA-CR-163557 ..... N81-12480* #
NASA-CR-163558 ..... N81-12478* #
NASA-CR-163560 ..... N81-12479* #
NASA-CR-163561 ..... N81-12488* #
NASA-CR-163562 ..... N81-12487* #
NASA-CR-163574 ..... N81-12500* #
NASA-CR-163744 ..... N81-12943* #
NASA-CR-163745 ..... N81-12357* #
NASA-CR-163746 ..... N81-12647* #
NASA-CR-163747 ..... N81-12646* #
NASA-CR-163748 ..... N81-12523* #
NASA-CR-163788 ..... N81-12675* #
NASA-CR-163791 ..... N81-12529* #
NASA-CR-163792 ..... N81-12439* #
NASA-CR-163795 ..... N81-12140* #
NASA-CR-163796 ..... N81-12684* #
NASA-CR-163797 ..... N81-12944* #
NASA-CR-163798 ..... N81-12551* #
NASA-CR-163799 ..... N81-12790* #
NASA-CR-163800 ..... N81-12525* #
NASA-CR-163801 ..... N81-12447* #
NASA-CR-163802 ..... N81-12786* #
NASA-CR-163803 ..... N81-12547* #
NASA-CR-163804 ..... N81-12548* #
NASA-CR-163805 ..... N81-12552* #
NASA-CR-163806 ..... N81-12549* #
NASA-CR-163807 ..... N81-12550* #
NASA-CR-163808 ..... N81-12553* #
NASA-CR-163809 ..... N81-12554* #
NASA-CR-165143 ..... N81-12546* #
NASA-CR-165145 ..... N81-12139* #
NASA-CR-165165 ..... N81-12255* #
NASA-CR-165169-VOL-1 ..... N81-12135* #
NASA-CR-165169-VOL-2 ..... N81-12136* #
NASA-CR-165169-VOL-3 ..... N81-12137* #
NASA-CR-165169-VOL-4 ..... N81-12138* #

NASA-NEWS-RELEASE-80-192 ..... N81-12964*

NASA-RP-1029 ..... N81-12760* #

NASA-SP-7011(211) N81-12723*
NASA-SP-7037(127) ..... N81-12011* #
NASA-SP-7043(22) ..... N81-12559* #

NASA-TM-58232 ..... N81-12543* #
NASA-TM-75763 ..... N81-12359* #
NASA-TM-78192 ..... N81-12325* #
NASA-TM-78194 ..... N81-12324* #
NASA-TM-78202 ..... N81-12747* #
NASA-TM-78316 ..... N81-12676* #
NASA-TM-80335-PT-1 ..... N81-12717* #
NASA-TM-80705 ..... N81-12298* #
NASA-TM-81211 ..... N81-12018* #
NASA-TM-81238 ..... N81-12065* #
NASA-TM-81352 ..... N81-12064* #
NASA-TM-81563 ..... N81-12226* #
NASA-TM-81570 ..... N81-12210* #
NASA-TM-81591 ..... N81-12171* #
NASA-TM-81614 ..... N81-12821* #
NASA-TM-81621 ..... N81-12358* #
NASA-TM-81623 ..... N81-12446* #
NASA-TM-81628 ..... N81-12817* #
NASA-TM-81863 ..... N81-12448* #
NASA-TM-81886 ..... N81-12039* #
NASA-TM-81892 ..... N81-12012* #
NASA-TM-81895 ..... N81-12173* #
NASA-TM-81897 ..... N81-12719* #
NASA-TM-81902 ..... N81-12155* #
NASA-TM-81904 ..... N81-12445* #
NASA-TM-81906 ..... N81-12822* #
NASA-TM-81908 ..... N81-12761* #
NASA-TM-81910 ..... N81-12977* #
NASA-TM-81982 ..... N81-12682* #
NASA-TM-81987 ..... N81-12966* #
NASA-TM-81991 ..... N81-12967* #
NASA-TM-81995 ..... N81-12762* #
NASA-TM-81998 ..... N81-12528* #
NASA-TM-81999 ..... N81-12976* #
NASA-TM-82008 ..... N81-12882* #
NASA-TM-82011 ..... N81-12296* #
NASA-TM-82013 ..... N81-12973* #
NASA-TM-82014 ..... N81-12961* #
NASA-TM-82019 ..... N81-12526* #
NASA-TM-82023 ..... N81-12678* #
NASA-TM-82024 ..... N81-12297* #
NASA-TM-82025 ..... N81-12679* #
NASA-TM-82026 ..... N81-12962* #
NASA-TM-82027 ..... N81-12828* #
NASA-TM-82029 ..... N81-12680* #
NASA-TM-82030 ..... N81-12957* #
NASA-TM-82032 ..... N81-12975* #
NASA-TM-82033 ..... N81-12965* #
NASA-TM-82035 ..... N81-12968* #
NASA-TM-82036 ..... N81-12963* #
NASA-TM-82037 ..... N81-12974* #
NASA-TM-82038 ..... N81-12958* #
NASA-TM-82039 ..... N81-12681* #
NASA-TM-82041 ..... N81-12959* #
NASA-TM-82046 ..... N81-12527* #
NASA-TM-82186 ..... N81-12486* #
NASA-TM-82187 ..... N81-12512* #
NASA-TM-82198 ..... N81-12519* #
NASA-TM-82199 ..... N81-12514* #
NASA-TM-82225 ..... N81-12493* #
NASA-TM-82307 ..... N81-12124* #
NASA-TM-82384 ..... N81-12955* #

NASA-TP-1178 ..... N81-12084* #
NASA-TP-1289 ..... N81-12356* #
NASA-TP-1498 ..... N81-12015* #
NASA-TP-1563 ..... N81-12744* #
NASA-TP-1716 ..... N81-12089* #
NASA-TP-1734 ..... N81-12109* #
NASA-TP-1742 ..... N81-12043* #
NASA-TP-1743 ..... N81-12812* #
NASA-TP-1748 ..... N81-12066* #
NASA-TP-1764 ..... N81-12361* #
NASA-TP-1767 ..... N81-12021* #

NATICK-TR-80/025 ..... N81-12425 #

NATICK/CEMEL-221 ..... N81-12425 #

NAVDAC-PUB-15 ..... N81-12936 #

NBSIR-80-2023 ..... N81-12232 #
NBSIR-80-2034 ..... N81-12231 #

NEAR-TR-158 ..... N81-12014* #
NEAR-TR-228 ..... N81-12451 #

NEWSLETTER-13 ..... N81-12522* #
NEWSLETTER-16 ..... N81-12521* #

NLR-MP-77026-U ..... N81-12473 #
NLR-MP-78017-U ..... N81-12802 #
NLR-MP-79016-U ..... N81-12186 #
NLR-MP-79017-U ..... N81-12474 #
NLR-MP-79026-U ..... N81-12742 #
NLR-MP-79029-U ..... N81-12382 #
NLR-MP-79034-U ..... N81-12036 #
NLR-MP-79042-U ..... N81-12081 #
NLR-MP-79044-U ..... N81-12475 #
NLR-MP-79045-U ..... N81-12743 #
NLR-MP-80002-U ..... N81-12476 #
NLR-MP-80003-U ..... N81-12477 #

NLR-TR-77104-U ..... N81-12033 #
NLR-TR-79002-U ..... N81-12538 #
NLR-TR-79011-U ..... N81-12187 #
NLR-TR-79020-U ..... N81-12252 #
NLR-TR-79063-U ..... N81-12034 #

NOSC/TR-341 ..... N81-12144 #
NOSC/TR-561 ..... N81-12686 #

NRC-18227 ..... N81-12394 #

NRCC-PROCEEDINGS-5 ..... N81-12835 #

NRL-MR-4157 ..... N81-12556 #
NRL-MR-4280 ..... N81-12409 #
NRL-MR-4322 ..... N81-12848 #
NRL-MR-4326 ..... N81-12857 #
NRL-MR-4334 ..... N81-12887 #
NRL-MR-4340 ..... N81-12699 #
NRL-MR-4341 ..... N81-12903 #
NRL-MR-4350 ..... N81-12850 #
NRL-MR-4353 ..... N81-12889 #

NTIA-SP-80-8 ..... N81-12933 #

NTIS/PS-78/0616 ..... N81-12756 #
NTIS/PS-78/0633 ..... N81-12640 #
NTIS/PS-78/0676 ..... N81-12735 #
NTIS/PS-78/0693 ..... N81-12636 #
NTIS/PS-78/0758 ..... N81-12666 #
NTIS/PS-78/0769 ..... N81-12254 #
NTIS/PS-78/0770 ..... N81-12253 #
NTIS/PS-78/0775 ..... N81-12715 #
NTIS/PS-78/0803 ..... N81-12758 #
NTIS/PS-78/0805 ..... N81-12354 #
NTIS/PS-78/0807 ..... N81-12667 #
NTIS/PS-78/0809 ..... N81-12114 #
NTIS/PS-78/0810 ..... N81-12783 #
NTIS/PS-78/0839 ..... N81-12642 #
NTIS/PS-78/0840 ..... N81-12639 #
NTIS/PS-78/0841 ..... N81-12638 #
NTIS/PS-78/0844 ..... N81-12718 #
NTIS/PS-78/0846 ..... N81-12784 #
NTIS/PS-78/0862 ..... N81-12293 #
NTIS/PS-78/0863 ..... N81-12295 #
NTIS/PS-78/0866 ..... N81-12736 #
NTIS/PS-78/0874 ..... N81-12294 #
NTIS/PS-78/0903 ..... N81-12437 #
NTIS/PS-78/0905 ..... N81-12436 #
NTIS/PS-78/0916 ..... N81-12694 #
NTIS/PS-78/0920 ..... N81-12774 #
NTIS/PS-78/0933 ..... N81-12879 #
NTIS/PS-78/0938 ..... N81-12716 #
NTIS/PS-78/0938 ..... N81-12880 #
NTIS/PS-78/0940 ..... N81-12970 #
NTIS/PS-78/0951 ..... N81-12757 #
NTIS/PS-78/0963 ..... N81-12773 #
NTIS/PS-78/0969 ..... N81-12541 #
NTIS/PS-78/0979 ..... N81-12934 #
NTIS/PS-78/0983 ..... N81-12322 #
NTIS/PS-78/0992 ..... N81-12421 #
NTIS/PS-79/0717 ..... N81-12640 #
NTIS/PS-79/0731 ..... N81-12756 #
NTIS/PS-79/0744 ..... N81-12735 #
NTIS/PS-79/0794 ..... N81-12666 #
NTIS/PS-79/0820 ..... N81-12715 #
NTIS/PS-79/0846 ..... N81-12636 #
NTIS/PS-79/0872 ..... N81-12784 #
NTIS/PS-79/0878 ..... N81-12667 #
NTIS/PS-79/0884 ..... N81-12758 #
NTIS/PS-79/0892 ..... N81-12354 #
NTIS/PS-79/0903 ..... N81-12718 #
NTIS/PS-79/0904 ..... N81-12114 #
NTIS/PS-79/0906 ..... N81-12783 #
NTIS/PS-79/0927 ..... N81-12642 #
NTIS/PS-79/0928 ..... N81-12639 #
NTIS/PS-79/0929 ..... N81-12638 #
NTIS/PS-79/0935 ..... N81-12736 #
NTIS/PS-79/0936 ..... N81-12293 #
NTIS/PS-79/0937 ..... N81-12295 #
NTIS/PS-79/0945 ..... N81-12774 #
NTIS/PS-79/0946 ..... N81-12294 #
NTIS/PS-79/0947 ..... N81-12757 #
NTIS/PS-79/0949 ..... N81-12254 #
NTIS/PS-79/0950 ..... N81-12253 #
NTIS/PS-79/0971 ..... N81-12934 #
NTIS/PS-79/0972 ..... N81-12716 #
NTIS/PS-79/0974 ..... N81-12970 #
NTIS/PS-79/0979 ..... N81-12773 #
NTIS/PS-79/0981 ..... N81-12421 #
NTIS/PS-79/0989 ..... N81-12694 #
NTIS/PS-79/0993 ..... N81-12541 #
NTIS/PS-79/0995 ..... N81-12437 #
NTIS/PS-79/0996 ..... N81-12436 #
NTIS/PS-79/0999 ..... N81-12879 #
NTIS/PS-79/1000 ..... N81-12880 #
NTIS/PS-79/1013 ..... N81-12322 #

NTSB-AAR-79-12 ..... N81-12044 #
NTSB-AAR-79-14 ..... N81-12045 #
NTSB-AAR-79-15 ..... N81-12046 #
NTSB-AAR-80-10 ..... N81-12042 #

NTSB-BA-80-8 ..... N81-12053 #

NUSC-TD-5868 ..... N81-12929 #
NUSC-TD-5906 ..... N81-12930 #

NWSY-TR-80-2 ..... N81-12259 #

ONERA-NT-1979-2 ..... N81-12207 #
ONERA-NT-1979-4 ..... N81-12826 #
ONERA-NT-1979-9 ..... N81-12292 #
ONERA-NT-1979-10 ..... N81-12352 #
ONERA-NT-1979-12 ..... N81-12751 #

ONERA-NT-1980-2 ..... N81-12467 #
ONERA-NT-1980-3 ..... N81-12878 #

ONERA-P-1978-5 ..... N81-12318 #

ONERA-RT-7/3373-SY ..... N81-12159 #

ORNL/EIS-85 ..... N81-12660 #

ORNL/TM-7417 ..... N81-12654 #
ORNL/TM-7418 ..... N81-12819 #
ORNL/TM-7427 ..... N81-12858 #

ORO-5260-4 ..... N81-12896 #

P/N-50560-PT-3 ..... N81-12423 #

PB80-194020 ..... N81-12532 #
PB80-204019 ..... N81-12933 #
PB80-204969 ..... N81-12759 #
PB80-205313 ..... N81-12643 #
PB80-205438 ..... N81-12384 #
PB80-208390 ..... N81-12668 #
PB80-813231 ..... N81-12667 #
PB80-813389 ..... N81-12641 #
PB80-813397 ..... N81-12640 #
PB80-813405 ..... N81-12755 #
PB80-813413 ..... N81-12756 #
PB80-813462 ..... N81-12665 #
PB80-813470 ..... N81-12666 #
PB80-813637 ..... N81-12774 #
PB80-813645 ..... N81-12736 #
PB80-813652 ..... N81-12354 #
PB80-813702 ..... N81-12783 #
PB80-813710 ..... N81-12114 #
PB80-813769 ..... N81-12735 #
PB80-813785 ..... N81-12637 #
PB80-813793 ..... N81-12636 #
PB80-813934 ..... N81-12642 #
PB80-813959 ..... N81-12715 #
PB80-814098 ..... N81-12718 #
PB80-814122 ..... N81-12638 #
PB80-814130 ..... N81-12639 #
PB80-814221 ..... N81-12785 #
PB80-814239 ..... N81-12784 #
PB80-814510 ..... N81-12295 #
PB80-814528 ..... N81-12293 #
PB80-814551 ..... N81-12294 #
PB80-814734 ..... N81-12253 #
PB80-814742 ..... N81-12254 #
PB80-814759 ..... N81-12758 #
PB80-814767 ..... N81-12773 #
PB80-814825 ..... N81-12716 #
PB80-814833 ..... N81-12757 #
PB80-814841 ..... N81-12934 #
PB80-814908 ..... N81-12421 #
PB80-814932 ..... N81-12880 #
PB80-814957 ..... N81-12879 #
PB80-814981 ..... N81-12541 #
PB80-814999 ..... N81-12970 #
PB80-815004 ..... N81-12694 #
PB80-815186 ..... N81-12322 #
PB80-815210 ..... N81-12437 #
PB80-815228 ..... N81-12436 #
PB80-815301 ..... N81-12321 #

PERME-MEMO-96 ..... N81-12167 #
PERME-MEMO-111 ..... N81-12282 #

PMTC-TP-80-22 ..... N81-12650 #

PNL-SA-7840 ..... N81-12704 #
PNL-SA-8438 ..... N81-12733 #

PNL-3194 ..... N81-12609 #

PNR-90013 ..... N81-12029 #
PNR-90014 ..... N81-12170
PNR-90018 ..... N81-12825 #
PNR-90019 ..... N81-12209
PNR-90020 ..... N81-12083

POLY-EE-79-0057 ..... N81-12763 #

PPG-439 ..... N81-12888 #

PPPL-1702 ..... N81-12797 #
PPPL-1704 ..... N81-12895 #

PR-3 ..... N81-12501* #
PR-4 ..... N81-12278 #
PR-6 ..... N81-12237 #
PR-50/51(44FR61372) ..... N81-12855 #

PRI-5 ..... N81-12894 #
PRI-6 ..... N81-12846 #
PRI-8 ..... N81-12892 #
PRI-11 ..... N81-12893 #
PRI-12 ..... N81-12890 #

PRRL-80-CR-28 ..... N81-12909 #

PS-1229 ..... N81-12745* #

PSU-IRL-SCI-467 ..... N81-12684* #

PUBL-96-45 ..... N81-12557 #

PWA-5523-92 ..... N81-12087* #

PX-13393 ..... N81-12745* #

P80-10202 ..... N81-12964*

QPR-2 ..... N81-12266 #

QR-2 ..... N81-12503* #
QR-3 ..... N81-12601 #
QR-8 ..... N81-12898 #
QR-11 ..... N81-12502* #
QR-11 ..... N81-12617 #

QTPR-3 ..... N81-12602 #
QTPR-3 ..... N81-12616 #
QTPR-12 ..... N81-12426 #

RADC-TR-80-45 ..... N81-12763 #
RADC-TR-80-201 ..... N81-12338 #
RADC-TR-80-215 ..... N81-12397 #
RADC-TR-80-232 ..... N81-12791 #
RADC-TR-80-262 ..... N81-12340 #

RAE-AERO-3479 ..... N81-12038 #

RAE-IT-167 ..... N81-12932 #

RAE-MAT-394 ..... N81-12469 #

RAE-SPACE-577 ..... N81-12153 #
RAE-SPACE-578 ..... N81-12539 #
RAE-SPACE-579 ..... N81-12693 #
RAE-SPACE-582 ..... N81-12132 #

RAE-STRUCT-BF/B/0832 ..... N81-12470 #

RAE-TM-AERO-1842 ..... N81-12468 #
RAE-TM-AERO-1854 ..... N81-12037 #

RAE-TM-FS-313 ..... N81-12320 #
RAE-TM-FS-334 ..... N81-12737 #
RAE-TM-FS-338 ..... N81-12734 #
RAE-TM-FS-348 ..... N81-12827 #

RAE-TM-MAT-339 ..... N81-12248 #

RAE-TR-79029 ..... N81-12113 #
RAE-TR-80034 ..... N81-12153 #
RAE-TR-80035 ..... N81-12469 #
RAE-TR-80037 ..... N81-12539 #
RAE-TR-80048 ..... N81-12932 #
RAE-TR-80052 ..... N81-12693 #
RAE-TR-80058 ..... N81-12470 #
RAE-TR-80060 ..... N81-12038 #
RAE-TR-80088 ..... N81-12132 #

REPT-22 ..... N81-12824 #
REPT-53 ..... N81-12950 #
REPT-73-76 ..... N81-12902 #
REPT-80-5-30-020 ..... N81-12829 #
REPT-80-9C1-NASSA-R2 ..... N81-12405* #
REPT-178 ..... N81-12484* #
REPT-302 ..... N81-12525* #
REPT-307 ..... N81-12669* #
REPT-695 ..... N81-12963* #
REPT-2365/4 ..... N81-12549* #
REPT-32999-F-E1-VOL-3 ..... N81-12161* #
REPT-47700 ..... N81-12234 #
REPT-64329-4 ..... N81-12913 #

RHR-80-019 ..... N81-12069 #

RSRE-MEMO-3248 ..... N81-12353 #
RSRE-MEMO-3249 ..... N81-12772 #

RSRE-80003 ..... N81-12775 #
RSRE-80004 ..... N81-12771 #
RSRE-80006 ..... N81-12319 #

R80-954440-17 ..... N81-12255* #
R80AEG313-VOL-3 ..... N81-12086* #

SAAB-FTK-0-79-19 ..... N81-12438
SAAB-FTK-0-79-22 ..... N81-12804

SAAB-L-0-1-B439 ..... N81-12028 #

SAAB-TN-AE-72-PT-2 ..... N81-12465 #
SAAB-TN-AE-73 ..... N81-12769 #

SAI-80-020-CP ..... N81-12192 #
SAI-023-79-713-LJ ..... N81-12883* #
SAI-245-80-348-LJ ..... N81-12846 #
SAI-254-80-347-LJ ..... N81-12894 #
SAI-254-80-442-LJ ..... N81-12892 #
SAI-254-80-477-LJ ..... N81-12893 #
SAI-254-80-493-LJ ..... N81-12890 #

SAND-80-0965C ..... N81-12276 #
SAND-80-1069 ..... N81-12795 #
SAND-80-1315C ..... N81-12367 #
SAND-80-1480C ..... N81-12623 #
SAND-80-1483C ..... N81-12243 #
SAND-80-1498 ..... N81-12796 #
SAND-80-1509C ..... N81-12402 #
SAND-80-1541C ..... N81-12401 #
SAND-80-1914C ..... N81-12242 #
SAND-80-7060 ..... N81-12608 #
SAND-80-7103 ..... N81-12610 #
SAND-80-7104 ..... N81-12607 #

SCSE-SR-3 ..... N81-12596 #

SDBEG-20 ..... N81-12766 #

SDSU-RSI-80-06 ..... N81-12511* #

SERI/PR-8170-1-T1 ..... N81-12616 #

SERI/RR-721-675 ..... N81-12574 #

SERI/SP-733-526 ..... N81-12572 #
SERI/SP-763 ..... N81-12578 #
SERI/SP-98156-1 ..... N81-12952 #

SERI/TP-631-791 ..... N81-12573 #
SERI/TP-631-841 ..... N81-12575 #

SERI/TR-332-586 ..... N81-12196 #
SERI/TR-721-575 ..... N81-12576 #
SERI/TR-0924-3 ..... N81-12586 #

SMU-EE-TR-80-9 ..... N81-12764 #

SNIAS-801-422-104 ..... N81-12247 #
SNIAS-801-440-101 ..... N81-12150 #
SNIAS-801-551-101 ..... N81-12052 #
SNIAS-801-551-102 ..... N81-12220 #
SNIAS-801-551-103 ..... N81-12221 #
SNIAS-801-551-104 ..... N81-12466 #

SP-5317-VOL-1 ..... N81-12067* #

SR-JO-00489 ..... N81-12514* #

SR-LO-00450 ..... N81-12489* #
SR-LO-00465 ..... N81-12483* #
SR-LO-00467 ..... N81-12515* #
SR-LO-00475 ..... N81-12478* #

SR-PO-00458 ..... N81-12496* #
SR-PO-00491 ..... N81-12520* #

SR-2 ..... N81-12416 #
SR-467 ..... N81-12684* #

SSD-80-0119-2-VOL-2 ..... N81-12560* #

SSL-SER-21-ISSUE-9 ..... N81-12175* #

SSS-R-80-4620 ..... N81-12428 #

STDR-80-22 ..... N81-12546* #

STS-ORDER-20282 ..... N81-12212 #

SU-STAN-CS-80-798 ..... N81-12334 #

SWRI-02-5382 ..... N81-12452 #
SWRI-15-5607 ..... N81-12442 #

TAU-1980/81 ..... N81-12416 #

TC-80-TR-0050 ..... N81-12379 #

TID-4500 ..... N81-12663 #

TN-167 ..... N81-12707 #
TN-1980-21 ..... N81-12790* #

TP-1979-8 ..... N81-12359* #

TPR-10 ..... N81-12585 #

TR-1 ..... N81-12307 #
TR-4 ..... N81-12904 #
TR-5 ..... N81-12915 #
TR-6 ..... N81-12230 #
TR-9 ..... N81-12193 #
TR-10 ..... N81-12830 #
TR-13 ..... N81-12687 #
TR-21 ..... N81-12911 #
TR-22 ..... N81-12912 #
TR-51B ..... N81-12779 #
TR-80-2 ..... N81-12307 #
TR-80-5 ..... N81-12808 #
TR-80-08-01 ..... N81-12788 #
TR-80-08-03 ..... N81-12780 #
TR-80-09-03 ..... N81-12750 #
TR-017 ..... N81-12228 #
TR-116 ..... N81-12190 #
TR-921 ..... N81-12767 #
TR-1127-1-VOL-2 ..... N81-12110* #
TR-7906 ..... N81-12807 #

TST-43 ..... N81-12056 #

UC-MIE-100180-10-ONR ..... N81-12741 #

UC-95F ..... N81-12237 #

UCID-18764 ..... N81-12587 #
UCID-175530-REV-1 ..... N81-12927 #

UCRL-15257 ..... N81-12427 #
UCRL-15264 ..... N81-12224 #

UDR-TR-79-63 ..... N81-12050 #
UDR-TR-80-33 ..... N81-12025 #
UDR-TR-80-99-VOL-1 ..... N81-12135* #
UDR-TR-80-100-VOL-2 ..... N81-12136* #
UDR-TR-80-101-VOL-3 ..... N81-12137* #
UDR-TR-80-102-VOL-4 ..... N81-12138* #

UILU-ENG-80-0502 ..... N81-12262 #

UR-3490-1900 ..... N81-12732 #

US-PATENT-APPL-SN-065676 ..... N81-12542*
US-PATENT-APPL-SN-153245 ..... N81-12862* #
US-PATENT-APPL-SN-178193 ..... N81-12724* #
US-PATENT-APPL-SN-178195 ..... N81-12390* #
US-PATENT-APPL-SN-182880 ..... N81-12422* #
US-PATENT-APPL-SN-182881 ..... N81-12156* #
US-PATENT-APPL-SN-183706 ..... N81-12362* #
US-PATENT-APPL-SN-189234 ..... N81-12174* #
US-PATENT-APPL-SN-191748 ..... N81-12389* #
US-PATENT-APPL-SN-195223 ..... N81-12388* #
US-PATENT-APPL-SN-195226 ..... N81-12283* #
US-PATENT-APPL-SN-195227 ..... N81-12386* #
US-PATENT-APPL-SN-195228 ..... N81-12387* #
US-PATENT-APPL-SN-199765 ..... N81-12330* #
US-PATENT-APPL-SN-199766 ..... N81-12407* #
US-PATENT-APPL-SN-199769 ..... N81-12211* #
US-PATENT-APPL-SN-200634 ..... N81-12363* #
US-PATENT-APPL-SN-206506 ..... N81-12331* #
US-PATENT-APPL-SN-915050 ..... N81-12542*

US-PATENT-CLASS-136-249 ..... N81-12542*
US-PATENT-CLASS-136-291 ..... N81-12542*
US-PATENT-CLASS-363-27 ..... N81-12542*
US-PATENT-CLASS-363-60 ..... N81-12542*
US-PATENT-CLASS-363-147 ..... N81-12542*

US-PATENT-4,217,633 ..... N81-12542*

USAARL-80-7 ..... N81-12740 #
USAARL-80-8 ..... N81-12730 #

USAAVRADCOM-TR-80-D-19 ..... N81-12075 #
USAAVRADCOM-TR-80-E-2 ..... N81-12058 #
USAAVRADCOM-TR-80-F-16 ..... N81-12176 #

USCG-D-50-80 ..... N81-12189 #

VB-0421018-B ..... N81-12164 #

VKI-PREPRINT-1979-12 ..... N81-12375 #
VKI-PREPRINT-1979-13 ..... N81-12376 #
VKI-PREPRINT-1979-15 ..... N81-12433 #
VKI-PREPRINT-1980-8 ..... N81-12377 #

VKI-TM-28 ..... N81-12383 #
VKI-TM-29 ..... N81-12635 #

VTH-LR-288 ..... N81-12131 #

WMO-485-VOL-2 ..... N81-12714 #
WMO-532 ..... N81-12707 #
WMO-555 ..... N81-12540 #

WR-78-11-VOL-1 ..... N81-12644 #
WR-78-11-VOL-2 ..... N81-12645 #

WT-6 ..... N81-12366 #

WTHD-118 ..... N81-12434 #

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